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Cushman

CE-4000
Radio Communications Test Set

MAINTENANCE MANUAL

TABLE OF CONTENTS

Section		Page
1.0	**GENERAL**	1-1
	INTRODUCTION	1-1
	SCOPE	1-1
	GENERAL DESCRIPTION	1-2
	SPECIFICATIONS	1-3
	ACCESSORIES	1-3
	OPTIONS	1-7
	BATTERY INSTALLATION	1-10
	BATTERY CHARGING	1-12
	SHIPPING AND RECEIVING	1-12
	Shipping	1-12
	Receiving	1-14
	Storage	1-14
2.0	**OPERATION.**	2-1
	INTRODUCTION	2-1
	ENVIRONMENTAL REQUIREMENTS	2-1
	Temperature	2-1
	RF Fields	2-1
	Power Requirements	2-1
	Turn-on and Warm-up	2-2
	POWER CONNECTION INSTRUCTIONS	2-2
	OPERATING CONTROLS	2-3
	OPERATING PROCEDURES	2-3
	Signal Level	2-3
	Transmitter Frequency Error Measurement	2-3
	Frequency Deviation Measurements	2-12
	Level Setting	2-13
	Modulation Measurement	2-13
	Transmitter Power Measurement	2-14
	CW Mode	2-15
	FM Mode	2-16
	SINAD Measurements	2-17
	External Oscilloscope Operation	2-18
3.0	**FUNCTIONAL DESCRIPTION**	3-1
	INTRODUCTION	3-1
	RECEIVE Mode	3-1
	GENERATE Mode	3-7
	Frequency Synthesis	3-7
	Microwave Casting	3-8
	Frequency Offset	3-9
	Output Circuitry	3-9

TABLE OF CONTENTS

Section		Page
3.0	**FUNCTIONAL DESCRIPTION (Continued)**	
	Displays	3-10
	RF Power	3-10
	SINAD	3-11
	Modulation/Demodulation	3-11
	Oscilloscope	3-11
	Power Supply and Audio	3-12
	Option 01, Battery	3-12
	Option 02, OCXO	3-12
	Option 03, Tone Synthesizer	3-12
	Option 04, Simulcast Paging	3-12
	CIRCUIT CARD DESCRIPTION	3-13
	RECEIVE/GENERATE Switch Assembly (1300)	3-13
	Attenuator Assembly (2100)	3-14
	Power Detection/Protection (2300)	3-15
	Output Level Calibration (2400)	3-16
	VHF VCO (3100)	3-17
	1.8 GHz Multiplier	3-18
	2 GHz IF (3300)	3-19
	20 MHz Sampler (3400)	3-20
	Final Mixer/Low Pass Filter (3500)	3-21
	Receiver/Converter (3600)	3-22
	1.8 GHz Cavity Filter (3700)	3-23
	Interdigital Filter (3900)	3-24
	Receiver Converter Regulator (3950)	3-25
	Divide-By-M PLL (4100)	3-26
	100 Hz Synthesizer (4200)	3-27
	Reference Frequency Generator (4300)	3-28
	MOD/DEMOD (4400)	3-29
	YIG Driver and 10.7 MHz IF (4500)	3-30
	Relay Control (4700)	3-31
	SINAD (4800)	3-32
	Power Meter Driver (4900)	3-33
	Power Supply, Rear Panel (5100)	3-34
	DC Switcher (5200)	3-35
	Linear Regulator (5300)	3-36
	High Level Amplifier (7100)	3-37
	High Voltage Power Supply (8300)	3-38
4.0	**TROUBLESHOOTING AND REPAIR**	4-1
	INTRODUCTION	4-1
	SAFETY CONSIDERATIONS	4-1
	FACTORY SERVICE	4-2
	DESIGN AND TESTING	4-2
	BOARD EXCHANGE PROGRAM	4-4
	PERFORMANCE TESTS	4-4

TABLE OF CONTENTS

Section		Page
4.0	**TROUBLESHOOTING AND REPAIR (Continued)**	
	Equipment Required	4-5
	Voltage Test	4-5
	Receive Mode	4-6
	SINAD Meter Check	4-7
	Receiver Sensitivity Check	4-8
	Generate Mode Checks	4-9
	Output Level Check	4-10
	Power Meter Driver Check	4-10
	TROUBLESHOOTING	4-11
	ADJUSTMENT PROCEDURES	4-26
	Yig Reference Voltage Adjustment	4-26
	Mod/Demod Board Adjustments	4-29
	Frequency Error Meter Adjustment (Receive Mode)	4-29
	Frequency Error Meter Adjustment (Generate Mode)	4-19
	Deviation Meter Adjustment	4-32
	Modulation Out	4-32
	Power Meter Driver Adjustment	4-32
	SINAD Meter Adjustment	4-35
	Frequency Accuracy Adjustment	4-36
5.0	**CALIBRATION**	5-1
	INTRODUCTION	5-1
	EQUIPMENT REQUIRED	5-2
	INITIAL CONTROL SETTINGS	5-2
	CALIBRATION PROCEDURES	5-3
	Visual Inspection	5-3
	Meter Mechanical Zero Adjustment	5-3
	Power Supply Check	5-3
	Master Oscillator Adjustment	5-3
	1.8 GHz Cavity Filter Alignment	5-4
	YIG PLL Adjustment	5-4
	YIG Loop Optimization	5-5
	DAC Linearity Check	5-5
	100 Hz Synthesizer Check	5-5
	VHF PLL CHECK	5-6
	Discriminator Balance	5-6
	Oscilloscope Horizontal Sweep Calibration	5-7
	Scope Mod Output Check	5-8
	Scope Demod Balance Check	5-8
	Scope External VERT IN Check	5-8
	HORIZ CAL/VERT CAL Check	5-9
	Audio Input Check	5-9
	Receive Mode Deviation Adjustment	5-10

FIGURES

Figure		Page
1-1	CE-4000 Radio Communications Test Set	x
1-2	CE-4000 Packaging Material	1-15
2-1	CE-4000 Controls, Connectors, and Indicators	2-8
2-3	CE-4000 Rear Panel Controls and Connectors	2-11
3-1	Functional Block Diagram of the CE-4000	3-2
3-2	Signal Flow Diagram	3-3
3-3	An Overall Block Diagram	3-4
3-4	RECEIVE/GENERATE Switch Assembly (1300)	3-13
3-5	Attenuator Assembly (2100)	3-14
3-6	Power Detection/Protection (2300)	3-15
3-7	Output Level Calibration (2400)	3-16
3-8	VHF VCO (3100)	3-17
3-9	1.8 GHz Multiplier (3200)	3-18
3-10	2 GHz IF (3300)	3-19
3-11	20 MHz Sampler (3400)	3-20
3-12	Final Mixer/Low Pass Filter (3500)	3-21
3-13	Receiver/Converter (3600)	3-22
3-14	1.8 GHz Cavity Filter (3700)	3-23
3-15	Interdigital Filter (3900)	3-24
3-16	Receiver Converter Regulator (3950)	3-25
3-17	Divide-By-M PLL (4100)	3-26
3-18	100 Hz Synthesizer (4200)	3-27
3-19	Reference Frequency Generator (4300)	3-28
3-20	MOD/DEMOD (4400)	3-29
3-21	YIG Driver and 10.7 MHz IF (4500)	3-30
3-22	Relay Control (4700)	3-31
3-23	SINAD (4800)	3-32
3-24	Power Meter Driver (4900)	3-33
3-25	Power Supply Rear Panel (5100)	3-34
3-26	DC Switcher (5200)	3-35
3-27	Linear Regulator (5300)	3-36
3-28	High Level Amplifier (7100)	3-37
3-29	High Voltage Power Supply (8300)	3-38
4-1	CE-4000 PCB and Component Location	4-3
4-2	Main Start Flow Diagram	4-12
4-3	CE-4000 Front Panel	4-13
4-4	Power Flow Diagram	4-14
4-5	4500 YIG Driver/10.7 MHz I.F	4-15
4-6	Frequency Synthesis Flow Diagram	4-16
4-7	Display Flow Diargram	4-17
4-8	Mod/Demod Flow Diagram	4-18
4-9	5300 Linear Regulator	4-19
4-10	3950 Receiver Converter	4-20
4-11	4000 Motherboard Interconnect	4-21
4-12	CE-4000 Interconnect Cables Top View	4-22
4-13	CE-4000 Interconnect Cables Side View	4-23
4-14	3000 Microwave Casting Interconnect	4-24

FIGURES

Figure	Description	Page
4-15	4900 Power Meter Driver Assembly	4-25
4-16	+10V YIG Reference Voltage	4-27
4-17	Reference Voltage Adjust	4-28
4-18	4400 MOD/DEMOD Adjustments	4-30
4-19	4700 Relay Control Assembly Discriminator Balance	4-31
4-20	4900 Power Meter Driver Assembly	4-34
4-21	4800 SINAD Assembly Adjustments	4-37
4-22	4300 Reference Frequency Assembly TCXO Adjustment	4-39
4-23	3000 Microwave Casting Assembly Frequency Accuracy	4-40
6-1	Front Panel Interconnect Diagram	6-5
6-2	Main Interconnect Diagram	6-6
6-3	Receive/Generate Switch Assembly (1300), Component Location	6-8
6-4	Receive/Generate Switch Assembly (1300), Schematic Diagram	6-9
6-5	Interconnect Diagram Attenuator Assembly . .	6-12
6-6	Attenuator Assembly (2100) Component Location	6-13
6-7	Attenuator Assembly (2100) Schematic Diagram	6-14
6-8	Interconnect Diagram RF Output Casting . . .	6-15
6-9	Output Protect/Power Detect (2300) Component Location	6-19
6-11	Output Level CAL (2400) Component Location .	6-24
6-12	Output Level CAL (2400) Schematic Diagram .	6-25
6-13	Microwave Casting Interconnect Diagram . .	6-26
6-14	VHF VCO (3100) Component Location	6-30
6-15	VHF VCO (3100) Schematic Diagram	6-31
6-16	1.8 GHz Multiplier (3200) Component Location	6-34
6-17	1.8 GHz Multiplier (3200) Schematic Diagram	6-35
6-18	2 GHz IF (3300) Component Location	6-40
6-19	2 GHz IF (3300) Schematic Diagram	6-41
6-20	20 MHz Sampler (3400) Component Location . .	6-45
6-21	20 MHz Sampler (3400) Schematic Diagram . .	6-46
6-22	Final Mixer/LP Filter (3500) Component Location	6-49
6-23	Final Mixer/LP Filter (3500) Schematic Diagram	6-50
6-24	Receiver/Converter (3600) Component Location	6-54
6-25	Receiver/Converter (3600) Schematic Diagram	6-55
6-26	Receiver/Converter Regulator (3950) Component Location	6-57
6-27	Receiver/Converter Regulator (3950) Schematic Diagram	6-58
6-28	Divide-By-M PLL (4100) Component Location . .	6-65
6-29	Divide-By-M PLL (4100) Schematic Diagram . .	6-66
6-30	100 Hz Synthesizer (4200) Component Location	6-79
6-31	100 Hz Synthesizer (4200) Schematic Diagram	6-80

FIGURES

Figure	Description	Page
6-32	Reference Frequency Generator (4300) Component Location	6-89
6-33	Reference Frequency Generator (4300) Schematic Diagram	6-90
6-34	Reference Frequency Generator (4300) (OP-04) Component Location	6-100
6-35	Reference Frequency Generator (4300) (OP-04) Schematic Diagram	6-101
6-36	MOD/DEMOD (4400) Component Location	6-113
6-37	MOD/DEMOD (4400) Schematic Diagram	6-114
6-38	YIG Driver and 10.7 MHz IF (4500) Component Location	6-127
6-39	YIG Driver/10.7 MHz IF (4500) Schematic Diagram	6-128
6-40	Relay Control (4700) Component Locations . . .	6-130
6-41	Relay Control (4700) Schematic Diagram	6-131
6-42	SINAD (4800) Component Location	6-136
6-43	SINAD (4800) Schematic Diagram	6-137
6-44	Power Meter Driver (4900) Component Location .	6-140
6-45	Power Meter Driver (4900) Schematic Diagram . .	6-141
6-46	Power Supply Interconnect (5000) Schematic Diagram	6-142
6-47	Power Supply, Rear Panel (5100) Component Location	6-144
6-48	Power Supply, Rear Panel (5100) Schematic Diagram	6-145
6-49	DC Switcher (5200) Component Location	6-154
6-50	DC Switcher (5200) Schematic Diagram	6-155
6-51	Linear Regulator (5300) Component Location . .	6-161
6-52	Linear Regulator (5300) Schematic Diagram . .	6-162
6-53	High Level Amplifier (7100) Component Location	6-164
6-54	High Level Amplifier (7100) Schematic Diagram	6-165
6-55	Oscilloscope (8200) Component Location	6-166
6-56	Oscilloscope (8200) Schmatic Diagram	6-167
6-57	H.V. Power Supply (8300) Component Location . .	6-171
6-58	H.V. Power Supply (8300) Schematic Diagram . .	6-172

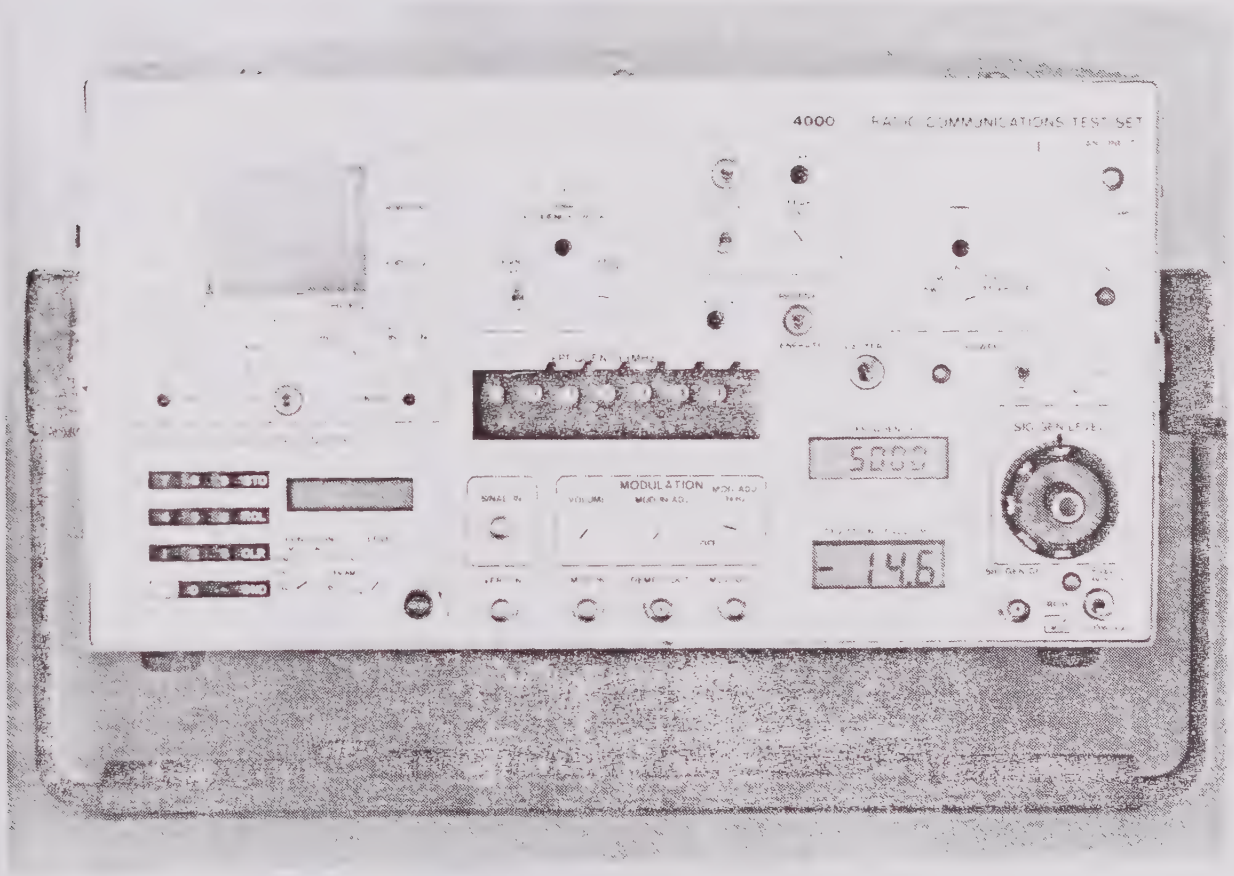


Figure 1-1. CE-4000 Radio Communications Test Set.

SECTION 1
GENERAL

INTRODUCTION

1.1 This manual applies to the CE-4000 Radio Communications Test Set. It contains the information necessary to operate the equipment, check its performance, make field level repairs, and adjust the equipment after making such repairs.

SCOPE

1.2 Six sections cover the following information:

a) SECTION 1, GENERAL, contains a general description, specifications , accessories, options, and shipping and receiving information.

b) SECTION 2, OPERATION, contains operating instructions for the CE-4000.

c) SECTION 3, FUNCTIONAL DESCRIPTION, describes functions of the CE-4000 and various assemblies in the instrument to a block diagram level. Provided are a functional description and a block diagram for each assembly. The block diagram is keyed to a component locator and schematic diagram contained in Section 6.

d) SECTION 4, TROUBLESHOOTING AND REPAIR, contains information required to verify performance and troubleshoot the instrument to the circuit card level.

e) SECTION 5, CALIBRATION PROCEDURES, describes the steps necessary to determine if the unit is functional and calibrate the instrument to factory specifications.

f) SECTION 6, DRAWINGS AND PARTS LISTS, provides a list of electronc components, component location diagram, and a schematic diagram for each assembly.

GENERAL DESCRIPTION

1.3 The CE-4000 Radio Communications Test Set is a Full Performance Test Set (FPTS). It contains, in a single unit, all the measurement and operating functions most often needed to test simplex and duplex frequency modulated (FM) transmitters, receivers, repeaters, and pagers. The CE-4000 operates in the VHF/UHF range of 25 to 999.9999 MHz. The test information is presented on an oscilloscope, a Frequency Error Meter, a Function Meter, and other displays.

1.3.1 Designed for the FM radio service and repair industry, the CE-4000 provides the most common service shop tests. The CE-4000 Options and Advanced Capability Modules (ACM) are designed to further tailor the instrument to handle specialized service needs. The standard 11 to 30 VDC input and optional battery adds versatility to the CE-4000 for use in making field repairs.

1.3.2 The CE-4000 is best utilized in maintenance and repair situations requiring relatively precise measurements of deviation, power, SINAD, receiver sensitivity, frequency error and modulation waveform distortion. The built-in oscilloscope can display demodulated audio frequencies for visual signal monitoring.

1.3.3 The oscilloscope automatically synchronizes the demodulated signal with accurate display of two ranges of deviation and modulation out. The oscilloscope vertical amplifier can be externally coupled in either AC or DC, with four ranges of external input and a bandwidth of 500 kHz. The oscilloscope and internal tone generator can be used for making Lissajous figure measurements.

1.3.4 For repair and tuning of receivers with severely degraded RF or IF gain, the CE-4000 provides a 200 millivolt (typical) uncalibrated high level signal generator output.

1.3.5 The CE-4000 Receiver Section is capable of measuring a two microvolt transmitted signal, with switchable bandwidths from 22 kHz to 280 kHz.

1.3.6 An internal output level calibration feature provides extremely flat response throughout the SIG GEN OUT frequency ranges at room temperature.

1.3.7 The CE-4000 SIG GEN OUT/RF IN port is protected from reverse power overload by an automatic switching circuit. If an RF input exceeds 500 milliwatts while the CE-4000 is in the GENERATE mode, the auto-protect circuit switches the instrument to RECEIVE mode and safely routes the surge to the RF power load.

SPECIFICATIONS

1.4 Specifications for the CE-4000 Radio Communications Test Set are given in Table 1-1.

ACCESSORIES

1.5 Each CE-4000 is shipped with an accessories kit containing the items listed in Table 1-2.

1.5.1 The standard operating voltages for the CE-4000 are 115 or 230 volts AC, or 11 to 30 volts DC. These voltages are selectable at the rear panel.

Table 1-1. CE-4000 Specifications.

ITEM	CHARACTERISTICS
RF Signal Generator	
Frequency	
Range	455 kHz to 999.9999 MHz
Resolution	Synthesized to 100 Hz
Offset	±15 kHz from dialed frequency
Accuracy	See Master Oscillator
Frequency Error Meter	±15% of full scale
Output	
Low Level	
Range	0.1 microvolt to 10 millivolt in 20dB steps continuous adjustment between steps
Accuracy	±4dB
High Level	
Range	To 200 millivolt minimum, 20dB steps continuous adjustment between steps
Accuracy	Uncalibrated
Spurious	
Harmonic	<-40dBc (-20dBc High level)
Non-Harmonic	-20dBc maximum <-40dBc typical
Residual FM	≤50 Hz RMS
Output	
Impedance	50 ohms nominal
Protection	Auto switch to Power mode and Receiver
Switching level	≤0.5 watts (1MHz to 1GHz)

Table 1-1. CE-4000 Specifications. (Cont'd)

ITEM	CHARACTERISTICS
Receiver	
Frequency	
Range	25 MHz to 999.9999 MHz
Resolution	Synthesized to 100 Hz
Accuracy	See Master Oscillator
Frequency Error Meter	+6% of full scale
Sensitivity	2 microvolts for 12dB SINAD nominal
(Selectivity-Narrow)	(3 microvolts for 12dB SINAD)
Selectivity	
Narrow	
-3dB Bandwidth	24 kHz maximum
-50dB Bandwidth	43 kHz maximum
Wide	
-3dB Bandwidth	290 kHz maximum
-50dB Bandwidth	560 kHz maximum
Residual Noise	<100 Hz peak at 100V
(Selectivity-Narrow)	<300 Hz peak at 20V
Input protection	RF part of Antenna Input BNC connector
Antenna Input	0.5V RMS maximum
Dynamic Range (20dB SINAD, Selectivity-Narrow)	
Non-Adjacent Channel	Unwanted signal = 0dB Wanted signal = ≤-35dBm
Adjacent Channel	≤ 130dB Below adjacent channel
Modulation/Demodulation	
Meter range	0 to 1.5 kHz and 0 to 15 kHz
Accuracy	
1.5 kHz range	
(5 Hz to 4 kHz tone)	±5% of full scale
15 kHz range	
6 to 15 kHz deviation	±10% of full scale
(1 kHz tone)	
0 to 6 kHz deviation	±2% of full scale
5 Hz to 4 kHz tone	
Internal 1 kHz	
Deviation	0 to 15 kHz Peak
Frequency Accuracy	See Master Oscillator
Distortion	>2% for ≤5 kHz peak deviation

Table 1-1. CE-4000 Specifications. (Cont'd)

ITEM	CHARACTERISTICS
External (Mod in)	
Frequency Response	5 Hz to 4 kHz*
Deviation Sensitivity	<30 mV P-P/1 kHz P-P Deviation full CW)
Input Impedance	>600 ohms
Distortion	<2% contributed by modulation circuit
Peak Flasher Range	<600 Hz to >15 kHz setable to deviation level
Mod Out	
Impedance	200 ohms ±10%
Level (into 600 ohms)	0 to ≥2V RMS
Demod Out	
Frequency Range	5 Hz to 4 kHz* nominal
Output Impedance	600 ohms ±10%
Level	0 to ≥300 mV RMS
Distortion	
Receiver (100V input)	
Wide	<2%
Narrow	<5%
Signal Generator	<2%
Oscilloscope	
Internal Vertical Input (Calibrated)	
Deviation Range (Full Scale, AC coupled)	±2 kHz, ±6 kHz
Accuracy	±5% of full scale
External Vertical Input (Calibrateed)	
Voltage Range	5 mV, 50 mV, 0.5V and 5V/DIV
Frequency Range	DC to 500 kHz (3dB)
Accuracy	±5% of full scale
Input Impedance	1 Meg ohm in parallel with 80 pf
Horizontal Sweep	
Range	10 mS, 1 and 10 microseconds/DIV
Accuracy	±5% of full scale
Vertical Vernier Range (Uncalibrated)	X1 to ≥X10
Horizontal Sweep Vernier Range (Uncalibrtated)	X1 to ≥X10

* Lower frequency response represents <5% pulse droop at a 5 Hz rate with 95% duty cycle.

Table 1-1. CE-4000 Specifications. (Concluded)

ITEM	CHARACTERISTICS
Master Oscillator	
TCXO Accuracy	±0.5 ppm
Aging	±1 ppm/yr
Temperature	±1 ppm from 0°
Warm-up time	30 seconds ≤1 ppm
SINAD	
Meter Scale Range	0 to 30dB
Range	0 to >20dB SINAD
Input level	0.5 to 10V rms
Accuracy (10, 12 and 20dB)	±1.5dB
Frequency	1 kHz ±1 Hz
Power Meter	
Range	1W to 15W and 10W to 150W
Accuracy	
1 MHz to 500 MHz	±10% of full scale*
500 MHz to 1 GHz	±20% of full scale*
Operating Time (150W and 26°C ambient)	≥5 minute
Alarm	Solid state internal audio alarm sounds when RF power is applied and heat-sink temperature exceeds 78°C
Alarm frequency	2850 Hz Typical
Default Mode	Switch to RF power mode when unit is unplugged or line power is off
Power Requirements	
AC Line	115V or 230V AC ±15%
Power input	80W maximum
Frequency	47 to 400 Hz
DC Line	
Voltage	11 to 30V DC positive or negative ground
Power Input	70W maximum

* Lower frequency response represents <5% pulse droop at a 5 Hz rate with 95% duty cycle.

Table 1-1. CE-4000 Specifications. (Concluded)

ITEM	CHARACTERISTICS
Environmental	
Temperature	
Operational	0°C to +55°C
Storage	-40°C to +75°C
Humidity	0 to 95% RH, 40°C
Altitude	
Operating	15,000 ft (4.572 Km)
Non-Operating	40,000 ft (12,191 Km)
Size	8" High x 14.5" Wide x 20" deep (20 x 37 x 51 CM)
Weight	39 lb (17.7 Kg) Basic unit 43 lb (19.52 Kg) with Option 01

Table 1-2. Accessories Kit.

QTY	ITEM	Part No.	QTY	ITEM	Part No.
1	Owner's Manual	5601-0091	1	PCB extractor	3875-0036
1	Whip Antenna	2346-0012	1	36" BNC/BNC cable	7037-0101
1	Front Cover				
1	CRT Viewing Hood	7005-0079	2	Spare 1/8 Amp RF Fuses	1955-0030
		2180-0200			

OPTIONS

1.6 The CE-4000 may be configured with a number of options that are hardwired into the instrument at the time it is manufactured. The CE-4000 may be returned to the factory or to the regional Service Centers for retro-fit of the options.

1.6.1 There are four available options for the CE-4000.

a) OP-01 DC Battery Power. Provides a charge circuit and internal battery for CE-4000 remote site operation.

b) OP-02 Oven Controlled Crystal Oscillator (OCXO). Provides increased accuracy and stability for all reference frequencies.

c) OP-03 Audio Synthesizer. Adds a synthesized variable tone generator with a frequency range from 1 to 9999.9 Hz. The level of both the variable tone and the fixed 1 kHz tone may be independently adjusted for simultaneous modulation to allow service of radio systems with signaling tones of other than 1 kHz and to provide audio modulation tones for voice quality checks.

d) OP-04 Simulcast Paging. Provides a digital frequency counter, dB Modulation Meter, and ovenized master oscillator for use in servicing simulcast paging transmitters. This option will allow a service technician to precisely measure the transmitter frequency to within 1 Hz and set the deviation of two or more paging transmitters to within 0.5dB of each other. Table 1-3 contains the specifications of each option.

Table 1-3. CE-4000 Option Specifications.

ITEM	CHARACTERISTICS
OPTIONS	
OP-01 DC Power (Internal)	
Battery	Rechargeable cell 12V at 6AH
Charge	Internal when unit is plugged into AC line or external DC supply
Recharging Time	8 hr typical
Operating Time	Full load 30 minute minimum
OP-02 Oven Controlled Crystal Oscillator	
Accuracy	0.3 PPM
Aging	Less than 0.003 ppm/day average over 7 days Less than 0.05 ppm/mo average over 6 months Less than 0.2 ppm/yr (during first year calibrated at 6 month intervals and thereafter at 12 month intervals)
Stability	Less than 0.05 ppm from 0°C to 55°C
Warm up time	2×10^{-7} per year after 25 minutes at 25°C Less than 5 min. from 20°C to 1×10^{-6} Less than 10 min. from 20°C to 1×10^{-7} after 1 hour on power

Table 1-3. CE-4000 Option Specifications. (Concluded)

ITEM	CHARACTERISTICS
OP-03 Audio Synthesizer	
Frequency Range	1 Hz to 9999.9 Hz
Accuracy	See Master Oscillator
Distortion	<2% total harmonic distortion
Deviation Range	0 to >6 kHz peak (5 Hz to 4 kHz* rate)
OP-04 Simulcast System Test	
Counter	
Input	IF frequency of CE-4000 (internally connected)
Count Range	+5 kHz from center frequency
Gate Time	1 sec approximately
Digits	4 Displayed
Resolution	1 Hz
Accuracy	Master Oscillator ±1 count
Blanking	Blanks to 00 when signal light is off or in GENERATOR mode
Digital Deviation Meter	
Polarity	Auto Polarity
Digits	3
Range	<-12dB to >+14dB (250 Hz to 5 kHz deviation range)
dB Reference	0dB at 1 kHz peak deviation
Accuracy	±0.5dB
Resolution	0.1dB
Frequency Range	50 Hz to 4 kHz tone
Master Oscillator	See OP-02 Oven Controlled Crystal Oscillator

* Lower frequency response represents <5% pulse droop at a 5 Hz rate with duty cycle.

ADVANCED CAPABILITY MODULES

1.7 Advanced Capability Modules (ACM) may be inserted by the test set operator to expand the functional capability of the CE-4000 for a given application. All modules contain an identical plug-in connector that inserts into a common receptacle located under the oscilloscope assembly.

1.7.1 The ACM Interface Kit must be installed in the CE-4000 if modules are to be used. The interface kit (Cushman Part Number 7021-0020) contains the cables, connectors, and guides required to allow the user to insert and remove the modules as needed. Return instruments ordered without the interface kit to the factory or regional Service Center for retro-fit. Table 1-4 contains the specifications of each ACM.

BATTERY INSTALLATION

1.8 If the CE-4000 is ordered with Option 01 (internal battery power option), the battery will be shipped disconnected from the instrument to meet Federal regulations.

1.8.1 To install the CE-4000 battery, proceed as follows:

a) Disconnect the instrument from the AC source.

b) Remove the top cover from the CE-4000 by removing the remaining screws and lift it.

Table 1-4. Advanced Capability Module Interface Specifications.

ITEM	CHARACTERISTICS
Power	
Ground	Chassis Ground
+10V Output	Regulated (current load <500 mA)
+10V Switched Output	+10V in Receive mode (total current >500 mA)
+5V Output Load Current	Regulated ≤500 mA
+12V Output Load Current	Regulated ≤500 mA
+25V Output Load Current	Regulated ≤50 mA
Mod Out	
Impedance	1K ohm ±10%
Level (into 1K ohm)	0 to ≥1V RMS
Demod Out	
Impedance	1K ohm ±10%
Level (into 1K ohm)	0 to 300 mV RMS
Frequency Range	5 Hz to 4 kHz*
Distortion	See Table 1-2

* Lower frequency response represents <5% pulse droop at a 5 Hz rate with 95% duty cycle.

Table 1-4. Advanced Capability Module Interface Specifications. (Concluded)

ITEM	CHARACTERISTICS
Mod In	
Impedance	3K ohm ±10%
Frequency Response	5 Hz to 4 kHz*
Deviation Sensitivity	≤375 mV p-p/1 kHz peak deviation
1kHz TTL output	As divided from Master Oscillator
Load	1"LS"TTL
Squelch Output	In monitor mode this input is TTL low when squelch on, TTL high when squelch is off
Load	1 TTL
10.7 MHz Sample Input	(Receiver Converter power disabled)
Impedance	50 ohms ±10%
Level	0dBm to -30dBm
10 MHz Reference Output	
Impedance	50 ohms nominal
Load	50 ohms nominal
Level	0dBm +3dBm
Accuracy	See CE-4000 Master Oscillator specification
75 kHz IF Output	IF frequency sinewave
Impedance	390 ohms ±20%
Level	0.5Vp-p min in monitor mode when signal is received
Frequency	75 ±15 kHz
Receiver Converter	+10V turns off Receiver Converter power Open turns Receiver Converter power on
Disable Input	
Required Current	≤2 mA
Internal Input	This input controls the oscilloscope horizontal axis when switched to Internal Mode
Impedance	5K ohm ±10%
Coupling	AC
Sensitivity	0.325V p-p/DIV±10%
Aux. LO Output	
Impedance	50 ohms nominal
Load	50 ohms nominal
Level	Greater than -30dBm
Frequency Range	10.7 MHz to 1010.7 MHz

* Lower frequency response represents <5% pulse droop at a 5 Hz rate with 95% duty cycle.

c) Place the battery assembly into the battery compartment with the terminals up and to the left, while facing the CE-4000 rear panel. The optional 12 volt pre-wired rechargeable battery (Cushman Part Number 1046-0012) will have a connector and cable assembly attached to the battery terminals when received.

d) Plug the harness connector located inside the battery compartment, into the connector attached to the battery.

e) Place the battery hold-down panel into the slot provided, on the left side of the battery compartment and press down into place over the battery. Insert the hold-down screw and tighten firmly.

f) Replace the top cover on the CE-4000 and reinstall the 18 retaining screws.

BATTERY CHARGING

1.9 When Option 01 is installed in the CE-4000, the battery will be recharged whenever the instrument is plugged into an AC power source (115 or 230 volts), and the rear panel power switch is in the AC position. It will also charge when connected to an external DC source and both rear panel power switches are in the DC and EXT DC positions. The battery will not charge in the BATTERY position.

SHIPPING AND RECEIVING

1.10 This section contains instructions for shipping, receiving inspection, and storage of the CE-4000.

Shipping

1.10.1 The following is a general guide for repacking the instrument for shipment. Use care when packing the instrument to minimize the possibility that it will be damaged during shipment.

1.10.2 If the original container becomes lost or damaged, a replacement may be purchased by contacting the Cushman Electronics Customer Service Department, or the procedures described in paragraph 1.10.5 may be performed.

WARNING

Disconnect the internal battery prior to shipment.

1.10.3 Always identify the instrument by model and serial number in all correspondence with the factory or the regional Service Centers.

NOTE

Before packing the instrument for shipment to the factory or regional Service Center for repair, attach a tag with the following information:

* Owner's Name
* Instrument Model Number
* Instrument Serial Number
* The service repair required.

1.10.4 When shipping the instrument in the original container:

a) Place the tagged instrument in the original packing material.

b) Place the instrument and packing material in the original container.

c) Make sure the container is well sealed with strong tape.

1.10.5 If the original container and packing material is not used, proceed as follows:

a) Wrap the tagged instrument in plastic or heavy paper and place in an inner container.

b) Place packing material around all sides of the wrapped instrument.

c) Place the instrument and inner container in a heavy carton or wooden box and seal with strong tape or with metal bands.

d) Mark the shipping container:

DELICATE
ELECTRONIC INSTRUMENT
FRAGILE

NOTE

Always pack the CE-4000 with the handle rotated fully to the top rear of the unit (handle touching the cover) to prevent structural damage to instrument during shipping and handling.

Receiving

1.10.6 When received, the CE-4000 Radio Communication Test Set will be packed in a shipping box with foam packaging designed to protect the equipment during shipment. It is recommended that the shipping box and foam packaging be placed in storage for reuse if it becomes necessary to ship the instrument for any reason, as shown in Figure 1-2.

Storage

1.10.7 If the CE-4000 is to be stored for an extended time, recharge, disconnect, and remove the battery and store it separately. Always recharge the battery before reuse after storage.

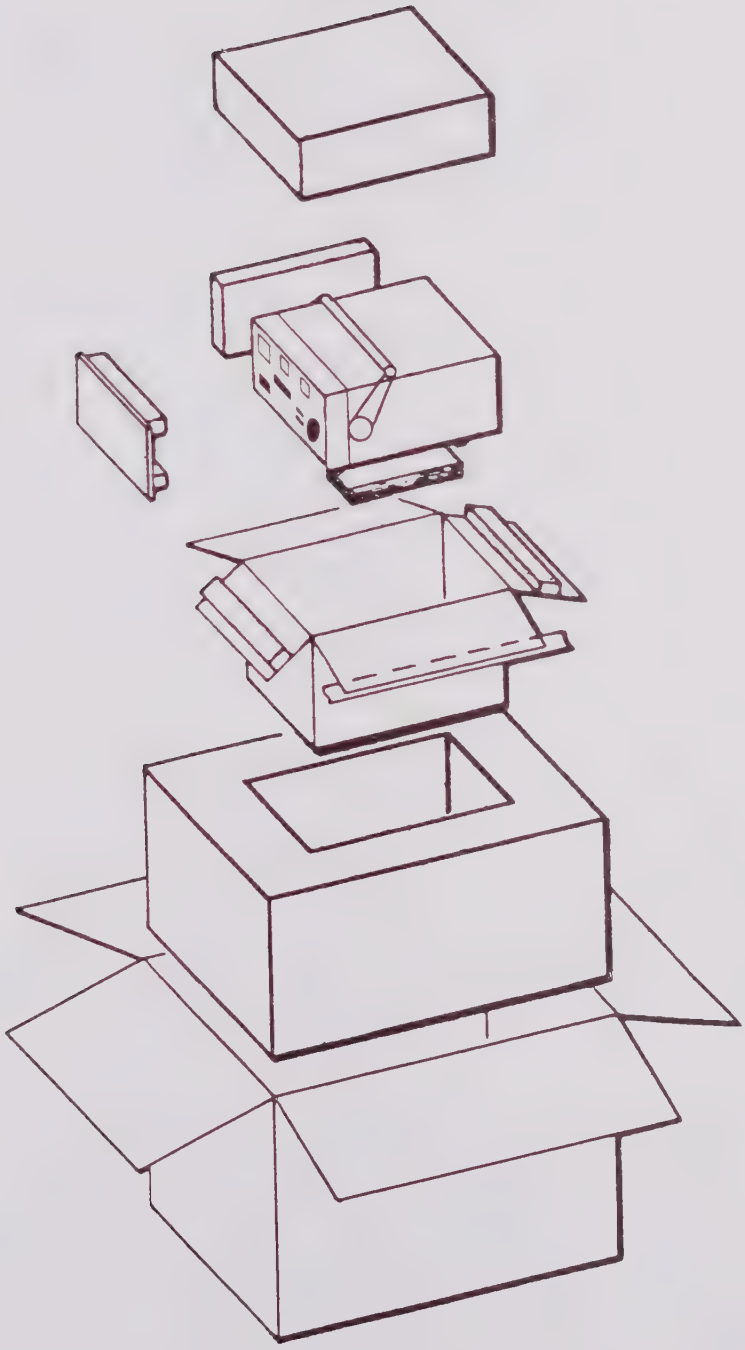


Figure 1-2. CE-4000 Packaging Material.

SECTION 2
OPERATION

INTRODUCTION

2.1 This section describes operating procedures for the CE-4000 and consists of the following sub-sections: Environmental Requirements, Power Requirements, Turn-on and Warm-up Procedure, Identification and Description of the Controls, Connectors, and Indicators.

ENVIRONMENTAL REQUIREMENTS

Temperature

2.2 The CE-4000 operates between 0°C (32°F) and +55°C (131°F). In the field these temperatures can easily be exceeded if proper precautions are not taken. Mountain top temperatures in winter (usually well below 0°C) can noticeably degrade battery output; while the internal temperature of a closed automobile trunk during summer daylight hours can exceed +65°C. Exceeding the upper or lower temperature limits for extended periods may not result in visible damage to the instrument, but may cause poor performance or actual malfunctioning.

RF Fields

2.3 Adjacent channel interference may be experienced where high RF radiation fields exist. This can occur near a high-power transmitter, or where many transmitters are in use. To correct for this, rotate the SQUELCH (SENSITIVITY) potentiometer to a lower level, and place the SELECTIVITY switch in the NARROW position. If that doesn't solve the problem, directly connect the transmitter to be monitored through a suitable RF attenuator to the CE-4000. For further information contact the Cushman Electronics Customer Service Department.

Power Requirements

2.4 The CE-4000 may be operated from several power sources: a 115V ±15% AC source, a 230V ±15%, 47 to 440 Hz AC source, an external +11V to +30V DC source, or an optional internal +12V battery. The CE-4000 is fuse protected at the rear panel for the source voltages. The type of source voltage (EXT DC, BATTERY, or AC) is selected at the CE-4000 rear panel switches. The AC voltage level (115 or 230 volts) is selected at the rear panel slide switch. The switch should be set to show the AC voltage selected. The CE-4000 requires (typically) 1/2 amp of current in 115V AC operation, and 7 1/2 amps of current in DC operation. The CE-4000 battery will operate for one half hour, nominally, at room temperature when fully charged.

Turn-on and Warm-up

2.5 When received, the CE-4000 can be operated immediately on AC or external DC power. If optional battery operation is desired, Option 01 must be installed. Additional or spare batteries may be obtained by ordering Cushman Part Number 1046-0012. Battery installation is described in Section 1 of this manual.

2.5.1 For AC operation, plug the power cord into a 115 or 230 volt AC, ±15%, 47 to 440 Hz source receptacle, as specified. For external DC operation, connect the rear panel external DC receptacle to an external DC source with the DC power cable, (positive to positive and negative to negative). There is no connection necessary for battery operation if the battery is already installed (see Battery Installation in Section 1).

NOTE

When the CE-4000 is used with an internal battery source, be sure the battery power indicator registers in the green area before operating. Fully discharging the battery may cause it to be damaged and require replacement. If the DC power source falls below 11V DC, the CE-4000 may cycle off and on.

2.5.2 The CE-4000 contains a Temperature Compensated Crystal Oscillator (TCXO) time base. Normally the maximum time required for warm-up after power is turned on is 30 seconds, but if the instrument has been stored at a temperature below 0°C (32°F) additional warm-up time may be required.

POWER CONNECTION INSTRUCTIONS

2.6 Prior to power-up of the CE-4000 perform the following procedures:

a) Select AC or DC operation on the rear panel. If AC is selected, also select either 115V or 230V on the AC slide switch (the voltage selected will be the one visable on the switch after selection). If DC is selected, EXT DC or BATTERY must be selected.

b) If BATTERY is selected, check the BATTERY indicator on the front panel for green condition.

OPERATING CONTROLS

2.7 The CE-4000 front panel controls, indicators, and connectors are listed in Table 2-1, and illustrated in Figures 2-1 and 2-2. The rear panel controls, indicators, and connectors are listed in Table 2-2 and illustrated in Figure 2-3.

OPERATING PROCEDURES

2.8 Operating procedures are grouped into three categories: the RECEIVE Mode, the GENERATE Mode, and External Oscilloscope Operation. The RECEIVE mode is used to test the signal characteristics of an externally connected transmitter. External transmitter signal characteristics test procedures described are: Signal Level, Transmitter Frequency Error Measurement, Frequency Deviation Measurement, Level Setting, Modulation Measurement, and Transmitter Power Measurement. The GENERATE mode is used to test the receive characteristics of an externally connected receiver. External receiver characteristics test procedures described are: CW Mode, FM Mode, and SINAD Measurements.

Signal Level

2.8.1 This procedure tests to determine if sufficient transmitter power is being received at the antenna input of the CE-4000 to proceed with other tests. Sufficient signal is indicated if the SIGNAL LEVEL LED is on when the external transmitter is keyed.

a) Place the CE-4000 POWER/OFF switch in the POWER position.

b) Place the RECEIVE/GENERATE switch in the RECEIVE position.

c) Connect the external antenna to the ANT INPUT connector on the front panel for off the air monitoring.

d) Turn the CE-4000 SQUELCH control to the minimum position (maximum sensitivity). With SQUELCH at minimum, background noise should be heard. Adjust SQUELCH control for no background noise.

e) Set the FREQUENCY (MHz) switches to the frequency to be monitored.

f) Observe the SIGNAL LEVEL LED and key the transmitter being tested. The LED should illuminate.

Table 2-1. CE-4000 Controls, Connectors, and Indicators.

NO.	NAME	FUNCTION
1	RANGE (kHz)	Two-position switch selects 15 kHz or 1.5 kHz ranges for the FREQUENCY ERROR Meter to display
2	FREQUENCY ERROR Meter	Displays the difference in frequency between the receive or generated frequency and the frequency dialed on the FREQUENCY (MHz) switches
3	Mechanical Zero	Used to mechanically set the meter immediately above it to zero position with power off
4	FREQ OFFSET	Adjusts the Signal Generator output ±15 kHz about the dialed frequency. Also used to electrically zero the FREQUENCY ERROR Meter (tune to the exact transmitted frequency) in RECEIVE mode
5	Function Meter	Reads FM deviation 1.5 kHz and 15 kHz, SINAD to -30dB, and POWER 15W and 150W when functions are selected at the function switch (ranges in brackets show full scale values)
6	Mechanical Zero	Used to mechanically set the meter immediately above it to zero position with power off
7	Function Switch	A five position switch used to select the desired scale on the function meter
8	ANT INPUT	Fused signal input connector which is used for making measurements in the RECEIVE mode
9	SIGNAL LEVEL	This LED lights when the selected RF signal at the ANT INPUT connector (in RECEIVE mode) exceeds the unit squelch level and can be measured
10	SQUELCH	Selects RF input sensitivity adjusting the level which the CE-4000 RECEIVER circuits will allow an input signal to pass
11	POWER (OFF)	Toggle switch used to apply power to the main systems (rear panel power source switches must be set to match the power source prior to turn on)

Table 2-1. CE-4000 Control, Connectors, and Indicators.

NO.	NAME	FUNCTION
12	Power LED	LED lights if the POWER (OFF) switch is turned on and the power source applied to the unit is the same as that selected by the rear panel switches
13	BATTERY Meter	In BATTERY mode, meter indicates battery charge status. Indicator in green shows charged, and in red indicates the battery requires recharging before use
14	RECEIVE/GENERATE	Selects the Receive or Signal Generator functions of the unit
15	Option Panel	In the standard version, a blank panel Optionally, a factory installed: a) Extended Audio Frequency Synthesizer (Model 403 ACM illustrated) b) Digital frequency counter and dB Modulation Meter for Simulacast Paging tests (OP-04)
16	MOD ADJ (1 kHz /OFF	Detented potentiometer turns on and adjusts the modulation level of the 1 kHz audio oscillator for internal modulation or external output
17	MOD OUT	BNC jack makes modulation signals available for external use
18	DEMOD OUT	Makes recovered RF signal audio available for external use
19	MOD IN ADJ	Adjusts the MOD IN audio input level to produce the desired amount of modulation from an external source
20	MOD IN	External modulation source input jack
21	UNLOCK	LED lights if frequency synthesizer is not locked on frequency
22	FREQUENCY (MHz	Selects the frequency of interest in both the monitor (RECEIVE) and Signal Generator (GENERATE) modes
23	ACM	Accepts Advanced Capability Modules (ACM for future expansions to the versatility of the CE-4000.

Table 2-1. CE-4000 Controls, Connectors, and Indicators.

NO.	NAME	FUNCTION
24	CRT Display	In normal oscilloscope mode, displays modulated signals received or generated by the CE-4000. Using the VERT IN jack (BNC), it can also be used as a 500 kHz external oscilloscope. An automatic synchronized circuit locks the sweep to the incoming internal or external signal
25	HORIZ/DIV	This 5 position switch selects calibrated time frames (in time per division) for the oscilloscope display
26	INTENSITY/OFF	In the OFF (detented) position, removes CRT display power. In other than OFF, it adjusts the brightness of the CRT trace
27	HORIZ POS	Potentiometer controls horizontal position of CRT display
28	HORIZ CAL	Detented potentiometer is used to vary the Horizontal CRT scale between the calibrated ranges of the HORIZ/DIV control
29	UNCAL (Horiz)	LED indicates that the HORIZ vernier control (HORIZ CAL) is not in the detented position
30	READ (+/-)	Toggle switch determines whether the PEAK LEVEL light and deviation scale on the Function Meter are indicating positivie or negative peaks of the signal being received or modulated
31	SELECTIVITY	Selects the receiver IF bandwidth (WIDE or NARROW) for RECEIVE mode functions
32	PEAKS	LED lights when the FM modulation peak deviation exceeds the level set by the PEAK LEVEL control
33	PEAK LEVEL	Adjusts peak modulation level at which the PEAKS LED indicator lights
34	SIG GEN LEVEL	RF output attenuator which adjusts the SIG GEN OUT level in five 20dB steps (0.1 mV thru 1 mV)
35	OFF/X10 (Fine)	Detented potentiometer provides an adjustment of the SIG GEN OUT level between the 20dB attenuator settings to give continuous coverage of output level. The OFF position turns off the output RF

Table 2-1. CE-4000 Controls, Connectors, and Indicators.

NO.	NAME	FUNCTION
36	LEVEL HIGH	LED lights when switched to HIGH LEVEL SIG GEN OUT
37	LEVEL (HIGH/LOW)	Toggle switch selects high level -1dBm uncalibrated Signal Generator output or low level calibrated Signal Generator output
38	SIGN GEN OUT/RF IN	BNC connector for the generated output RF signal from the CE-4000, or for the input power to be measured. Protected from accidental transmitter keying by an automatic switching circuit
39	VOLUME	Adjusts the audio signal level to the internal loudspeaker
40	SINAD IN	BNC input to measure the 10, 12, 20, and 30dB SINAD sensitivity of a receiver under test. Reading is made on the center scale of the Function Meter
41	VERT IN	External input for vertical CRT deflection. Used when CRT is used as an external oscilloscope
42	AC/DC	Switch selects AC or DC input coupling for an external input to the VERT IN jack of the oscilloscope
43	VERT/DIV	This 8 position switch selects calibrated vertical sensitivities for the CRT display
44	VERT CAL	Detented potentiometer is used to vary the Vertical CRT scale between the calibrated ranges of the VERT/DIV control
45	UNCAL (VERT)	This LED indicates that the VERT CAL Control is not in the detented (calibrated) position
46	VERT POS	Potentiometer controls the vertical position of the CRT display
47	FOCUS	Potentiometer adjusts sharpness of the CRT trace

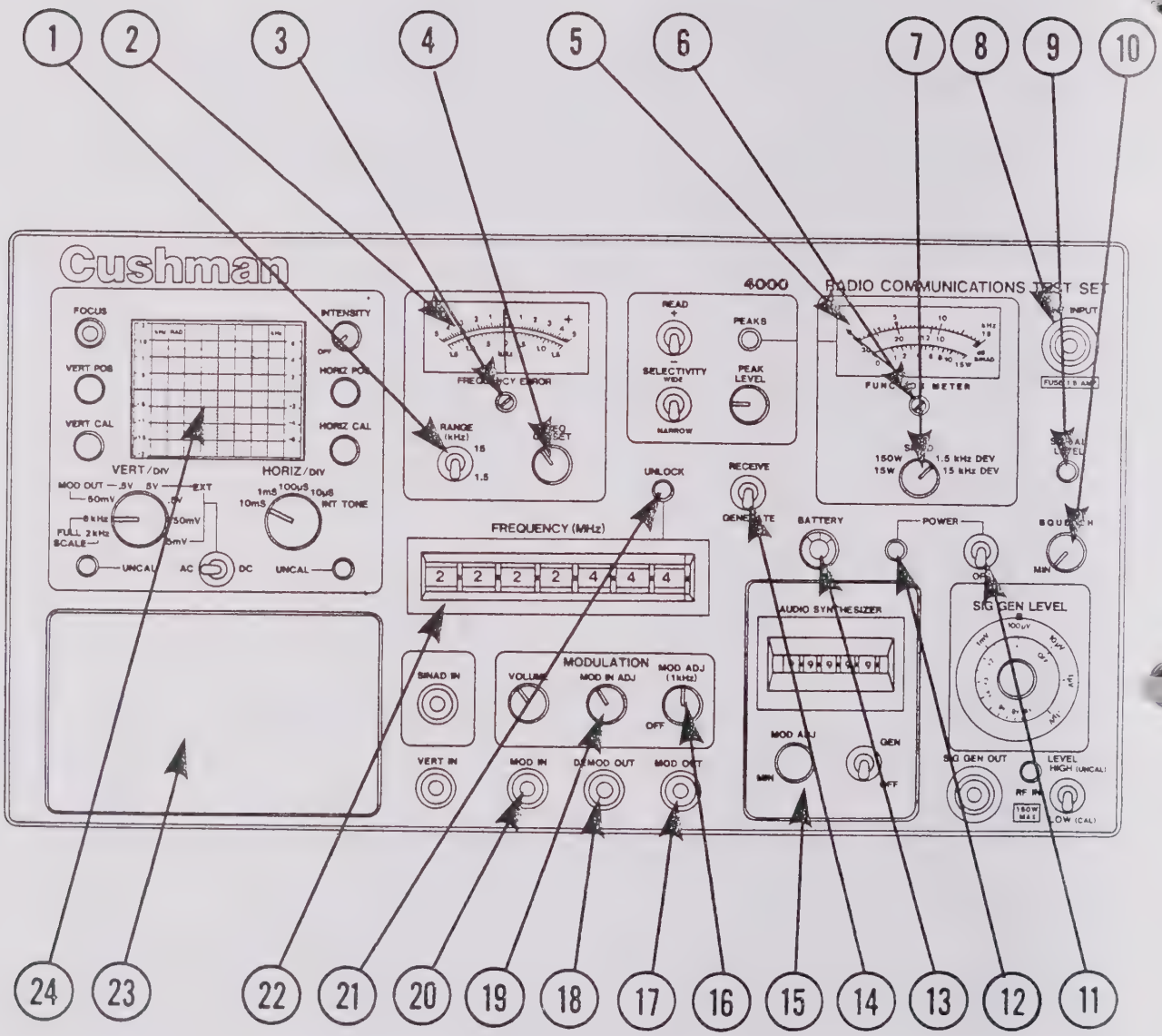


Figure 2-1. CE-4000 Controls, Connectors, and Indicators.

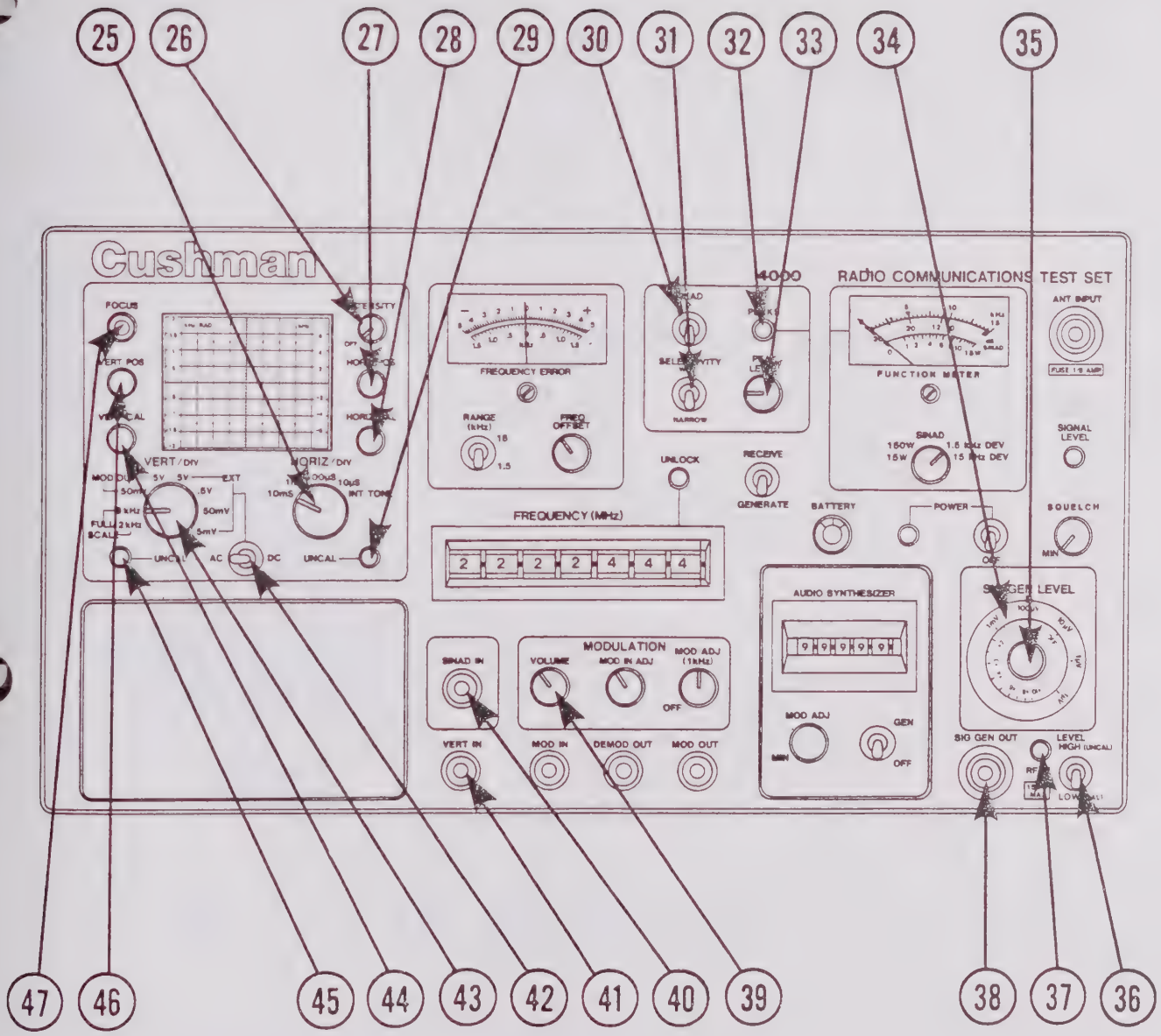


Figure 2-1. CE-4000 Controls, Connectors, and Indicators. (Concluded)

Table 2-2. CE-4000 Rear Panel Controls and Connectors.

NO.	NAME	FUNCTION
1	RF Load	RF power load used to dissipate up to 150W for more than 5 minutes
2	ID Plate	Provides MODEL number and SERIAL number information
3	Cord Rack	Storage rack for AC or DC POWER cord(s)
4	AC In	Connector for three conductor AC power cord
5	115/230	Slide switch to select either 115V AC or 230V AC power source
6	EXTERNAL DC	Power cord connector for an 11 to 30V DC input
7	FUSE	Fuse for DC power source, (7 1/2A FB)
8	FUSE	Fuse for AC power source, (1 1/2A SB 115V or 3/4A SB 230V)
9	AC/DC	Rocker switch selects basic power type
10	BATTERY/EXT DC	Rocker switch selects type of DC power as being from the internal battery or from an external 11 to 30V DC source

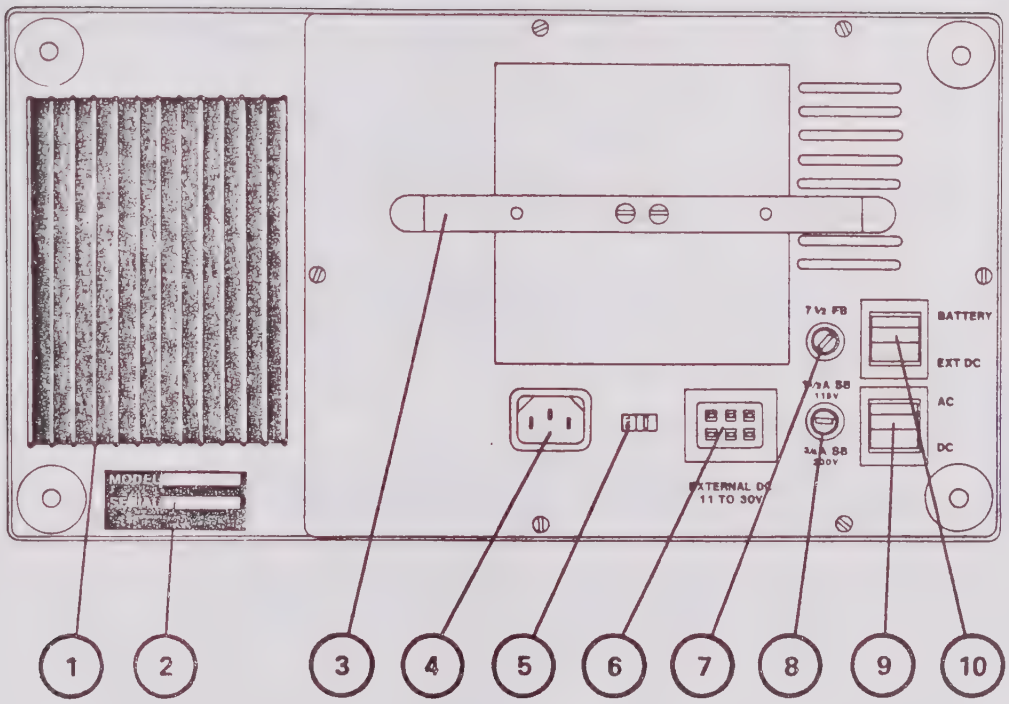


Figure 2-3. CE-4000 Rear Panel Controls and Connectors.

Transmitter Frequency Error Measurement

2.8.2 This procedure tests for the difference in frequency between the received transmitter carrier signal and the frequency selected on the FREQUENCY (MHz) switches. The difference between the two frequencies is indicated on the kHz scale of the FREQUENCY ERROR Meter.

If the needle reads on the plus (+) side of the meter, the test signal is above the selected frequency. If the needle reads on the minus (-) side of the meter, the test signal is below the selected frequency. Perform the procedure as follows:

a) Perform steps (a) through (e) in paragraph 2.8.1.

b) Set the FREQUENCY ERROR Meter RANGE (kHz) switch to either 1.5 or 15 kHz, for the frequency range that gives an on scale reading on the FREQUENCY ERROR Meter.

c) Read the FREQUENCY ERROR Meter. If Option 04 is installed in the CE-4000 read the frequency error to within 1 Hz on the liquid crystal display marked "IF FREQUENCY".

Frequency Deviation Measurements

2.8.3 This procedure tests frequency modulation of the incoming RF signal. Deviation is displayed directly in kHz on the Function Meter and also as vertical deflection on the oscilloscope. The oscilloscope may also be used to observe distorted wave form characteristics during this test. Perform the procedure as follows:

a) Repeat steps (a) through (e) of Paragraph 2.8.1

b) Set the Function Meter switch to 15 kHz Deviation.

c) Set the oscilloscope VERT/DIV switch to the 6 kHz position.

d) Set the FREQUENCY ERROR Meter RANGE to the 15 kHz or 1.5 Range as required.

e) Key the transmitter being tested.

f) Read the modulation in kHz on the upper scale of the Function Meter.

g) Read audio deviation frequency on the oscilloscope horizontal scale. If Option 04 is installed, read audio deviation in dB on the DEVIATION LEVEL (dB) display.

h) Read audio deviation peaks on the oscilloscope vertical scale.

Level Setting

2.8.4 This procedure tests to determine if the signal from the transmitter under test is exceeding a desired level. Excessive modulation of the transmitter is indicated when the PEAKS light turns on. Perform the procedure as follows:

a) Repeat steps (a) through (e) of Paragraph 2.8.1.

b) Set the READ +/- switch to the desired monitor positon (+ for the upper modulation peaks and - for lower peaks).

c) Place the RECEIVE/GENERATE switch in the GENERATE position, and adjust the MOD ADJ (1 kHz) control until the DEVIATION Meter reads the preset level desired.

d) While the RECEIVE/GENERATE switch is still in the GENERATE position, adjust the MOD ADJ (1 kHz) switch tone until the DEVIATION Meter reads the preset level desired.

e) Return the RECEIVE/GENERATE switch to the RECEIVE position.

NOTE

When incoming modulation exceeds the level preset in step (c) above, the PEAKS light will turn on, alerting the operator.

Modulation Measurement

2.8.5 This procedure tests the external transmitter modulation. A composite audio tone may be generated to modulate a transmitter by selecting the Model 403 ACM Audio Synthesizer. The Model 403 ACM Audio Synthesizer must be installed in the CE-4000 for this test procedure. Levels for both the Model 403 ACM and CE-4000 1 kHz tones are independently controlled by the MOD ADJ on the Audio Synthesizer Module and by the MOD ADJ (1 kHz) on the CE-4000 MODULATION section. The modulation frequency is determined by the number indicated on the Audio Synthesizer Thumbwheel switches. Perform the procedure as follows:

a) Repeat steps (a) through (e) of Paragraph 2.8.1.

b) Turn on the oscilloscope with the INTENSITY/OFF control. Adjust the INTENSITY and FOCUS controls for a sharp, clear trace on the CRT.

c) Set the Model 403 Audio Synthesizer Thumbwheel switches to the modulation frequency to be measured.

d) Center the trace on the oscilloscope with the VERT POS control and turn the HORIZ/DIV control to INT TONE.

e) Key the transmitter.

f) Turn the MOD ADJ control on the CE-4000 Model 403 ACM until the Lissajous figure is large enough to be easily viewed on the CE-4000 CRT.

g) Adjust the Audio Synthesizer Thumbwheel switches until a steady, non-rotating, single loop Lissajous figure is observed. The input modulation frequency is that frequency selected on the Thumbwheel switches when the Lissajous figure is steady.

Transmitter Power Measurement

2.8.6 This procedure tests to determine the amount of power transmitted by the external transmitter. Power is indicated in watts on the Function Meter. Perform the procedure as follows:

Do not use the CE-4000 with the power load on or near flammable materials. If over 150W is keyed into the unit or a 150W transmitter is keyed-up for over 5 minutes, the internal power load will heat beyond safe limits triggering an audible warning alarm. Continued application of power after the audible alarm sounds can result in extreme high temperature build up in the load heat-sink. After power measurements allow approximatley 30 minutes for the heat sink to cool before transporting the CE-4000.

a) Repeat steps (a) through (e) of paragraph 2.8.1.

b) Set the Function Meter switch to the 150W position.

c) Connect the output of the transmitter under test directly to the SIG GEN OUT/RF IN connector with a suitable RF cable.

d) Key the test transmitter.

e) Read transmitted power directly on the bottom scale of the Function Meter (15W = 150W). If input power is less than 2 1/2 major increments on the scale, move the Function Meter switch to the 15W position and re-key the transmitter.

CW Mode

2.8.7 This procedure tests for controlled unmodulated CW RF to be transmitted from the CE-4000 at specified frequencies and power levels. The receiver under test may then be monitored for response with front panel meters and indicators, or other test instruments for compliance with receiver specifications. Perform the procedure as follows:

a) Connect a 50 ohm coaxial cable from the CE-4000 SIG GEN OUT/RF IN connector to the antenna or RF in connector of the receiver under test.

b) Turn the instrument on and allow it to warm-up for 30 seconds.

c) Set the RECEIVE/GENERATE switch to the GENERATE position.

d) Set the FREQUENCY (MHz) switches to the desired frequency.

e) Set the LEVEL switch to the LOW (CAL) position to measure signal levels below 10 mV. If more than 10 mV is to be measured, set the LEVEL switch to the HIGH (UNCAL) position.

f) Turn the MOD ADJ (1 kHz) switch to the OFF position. If the Model 403 ACM Audio Synthesizer is installed, place the ON/OFF switch to OFF.

g) Adjust the FREQ OFFSET control for zero on the FREQUENCY ERROR Meter. This calibrates the FM center frequency to the FREQUENCY (MHz) switches for error-free meter reading.

h) The Signal Generator output is available at the SIG GEN OUT/RF IN connector on the front panel. Level is controlled by adjusting the SIG GEN LEVEL step attenuator and its concentric OFF/X10 fine control.

FM Mode

2.8.8 This procedure tests for controlled modulated FM signals transmitted from the CE-4000 at specified frequencies, power levels and modulation levels. The receiver under test may than be monitored for response with front panel meters test instruments, or other indicators, and for general receiver audio response.

a) Complete steps (a) through (e) of paragraph 2.8.7.

b) Place the Function Meter switch to either the 1.5 kHz or 15 kHz deviation range as needed.

c) Turn the MOD ADJ (1 kHz) switch on, or connect an external modulation signal to the MOD IN jack. If the Model 403 ACM Audio Synthesizer is installed, turn the ON/OFF switch to ON.

d) Turn the MOD ADJ (1 kHz), MOD IN ADJ or the Model 403 ACM switch until the deviation scale of the Function Meter shows the desired FM deviation. The modulating signal may be audibly monitored with the CE-4000 loudspeaker.

e) Place the oscilloscope VERT/DIV switch to the 6 kHz position for a deviation (vertical)-vs-frequency (horizontal) display.

f) Adjust the PEAK LEVEL control to turn on the PEAKS light when deviation exceeds the preset level as follows:

1) Turn the PEAK LEVEL control until the PEAKS light just lights.

2) Turn it back until the light just barely turns off.

g) Set the RECEIVE/GENERATE switch to RECEIVE. The LED will now light if the set modulation level is exceeded.

SINAD Measurements

2.8.9 This procedure tests for receiver audio quality, sensitivity, alignment and repair procedures to be performed on the receiver under test. An audio load is required for SINAD measurements, this requirement may be satisfied by using a "Demod Out" jack, if available; an "Earphone" jack, if speaker is not muted with plug in place; or a hardwired coaxial cable connection (center conductor to speaker "+", shield to "-") in parallel with the test receiver's loudspeaker. Perform the procedure as follows:

a) Connect a coaxial cable to the demodulated output of the test receiver.

b) Connect a coaxial cable from the CE-4000 SIG GEN OUT jack to the test receiver antenna input.

c) Set the RECEIVE/GENERATE switch to GENERATE.

d) Set the FREQUENCY (MHz) switches to the frequency of the receiver under test.

e) Modulate the CE-4000 output with a 1 kHz tone at 50 to 80% of the test receiver's selectivity.

f) Set the CE-4000 SIG GEN LEVEL attenuator to 1 mV with the OFF/X10 control to X1 (minimum).

g) Adjust the receiver volume control until output power to the speaker is at half its rated level.

h) Set the CE-4000 Function Meter switch to the SINAD position.

i) Adjust the FREQ OFFSET control until the FREQUENCY ERROR Meter is centered (zero error).

j) Reduce the CE-4000 SIG GEN LEVEL until 12dB SINAD is read on the Function Meter, RF level should be at least equal to the receiver sensitivity specification.

k) For precise measurements of SINAD sensitivity, refer to the Electronic Industries Association's Standard #RS-204-A titled: "MINIMUM STANDARDS FOR LAND MOBILE COMMUNICATIONS FM OR AM RECEIVERS 25-470 MHz".

External Oscilloscope Operation

2.8.10 The CE-4000 Communications Test Set oscillocope may be operated as an independent DC to 5000 kHz oscilloscope by making the following connections and control settings:

Prolonged display of a stationary signal or trace of high intensity may damage the CRT phosphor coating. The intensity should not be set higher than necessary for comfortable viewing. Reduce the intensity to zero when the oscilloscope is not in use.

a) Place the CE-4000 POWER/OFF switch in the POWER position.

b) Set the EXT (AC/DC) scope input switch to the position corresponding to the type of signal being measured.

c) Connect the external signal to the VERT input connector.

d) Turn the oscillocope on INTENSITY/OFF control to mid-range.

e) Place the VERT/DIV switch and the HORIZ/DIV switch to the desired positions for viewing input signal amplitude and frequency. If the input signal amplitude is unknown, set the VERT/DIV switch to the EXT 5V/DIV position.

f) Adjust the INTENSITY and FOCUS controls for a sharp, clear trace on the CRT.

g) Center the trace on the CRT with the HORIZ POS and VERT POS oscilloscope controls.

SECTION 3
FUNCTIONAL DESCRIPTION

INTRODUCTION

3.1 This section includes a block diagram and discussion of the CE-4000. The discussion is divided into a functional description relative to the Functional Block Diagram, Figure 3-1; a discussion of frequency synthesis, illustrated in the Signal Flow Diagram Figure 3-2; an Overall Block Diagram discussion related to Figure 3-3; and circuit card descriptions, each followed by a block diagram.

FUNCTIONAL DESCRIPTION

3.2 The CE-4000 operates in two functional modes: RECEIVE and GENERATE.

RECEIVE Mode

3.2.1 In the RECEIVE mode of operation the signal coming into the CE-4000 is mixed with a local oscillator (LO) frequency, determined by the setting of the FREQUENCY (MHz) switches on the front panel.

3.2.2 The mixed input and local oscillator frequencies are sent to a 10.7 MHz crystal bandpass filter where the signal is amplified, filtered, limited, and mixed with a 10 MHz reference frequency.

3.2.3 The 10 MHz reference frequency is subtracted from the 10.7 MHz IF to produce 700 kHz, and a 625 kHz reference frequency is subtracted from this signal to produce the nominal 75 kHz output frequency.

3.2.4 The 75 kHz output frequency is sent to a frequency modulation discriminator, and is presented as an audible signal and as visual front-panel meter displays.

3.2.5 The local oscillator signal used to down-mix the incoming signal in the RECEIVE mode is derived from a 5 MHz time base. The 5 MHz is added to a 40 MHz reference frequency in the low frequency synthesizer.

3.2.6 The resulting 45 MHz frequency is added to a phase-locked-loop VCO frequency, filtered, divided, and mixed, and sent to a PIN attenuator which provides the fine power control of the signal generate section.

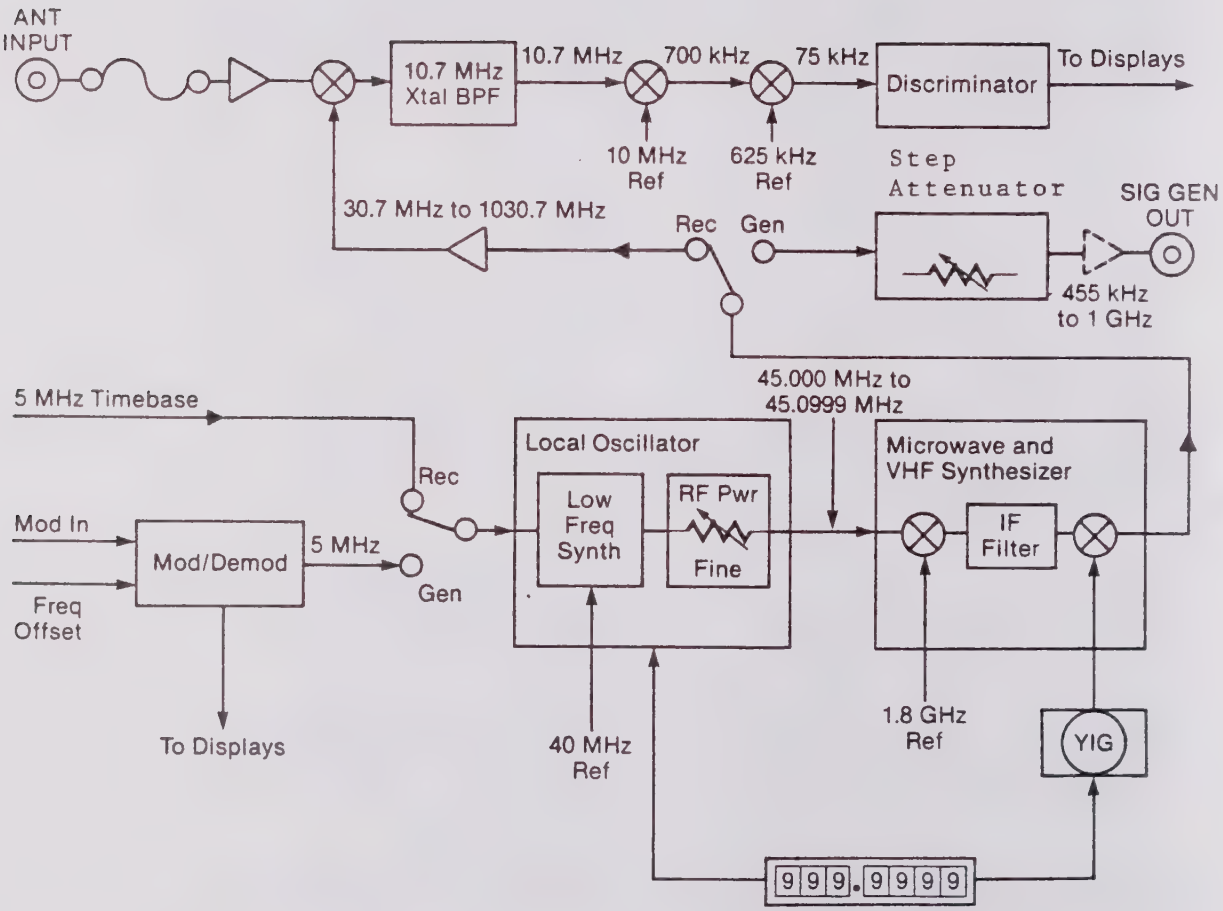


Figure 3-1. Functional Block Diagram of the CE-4000.

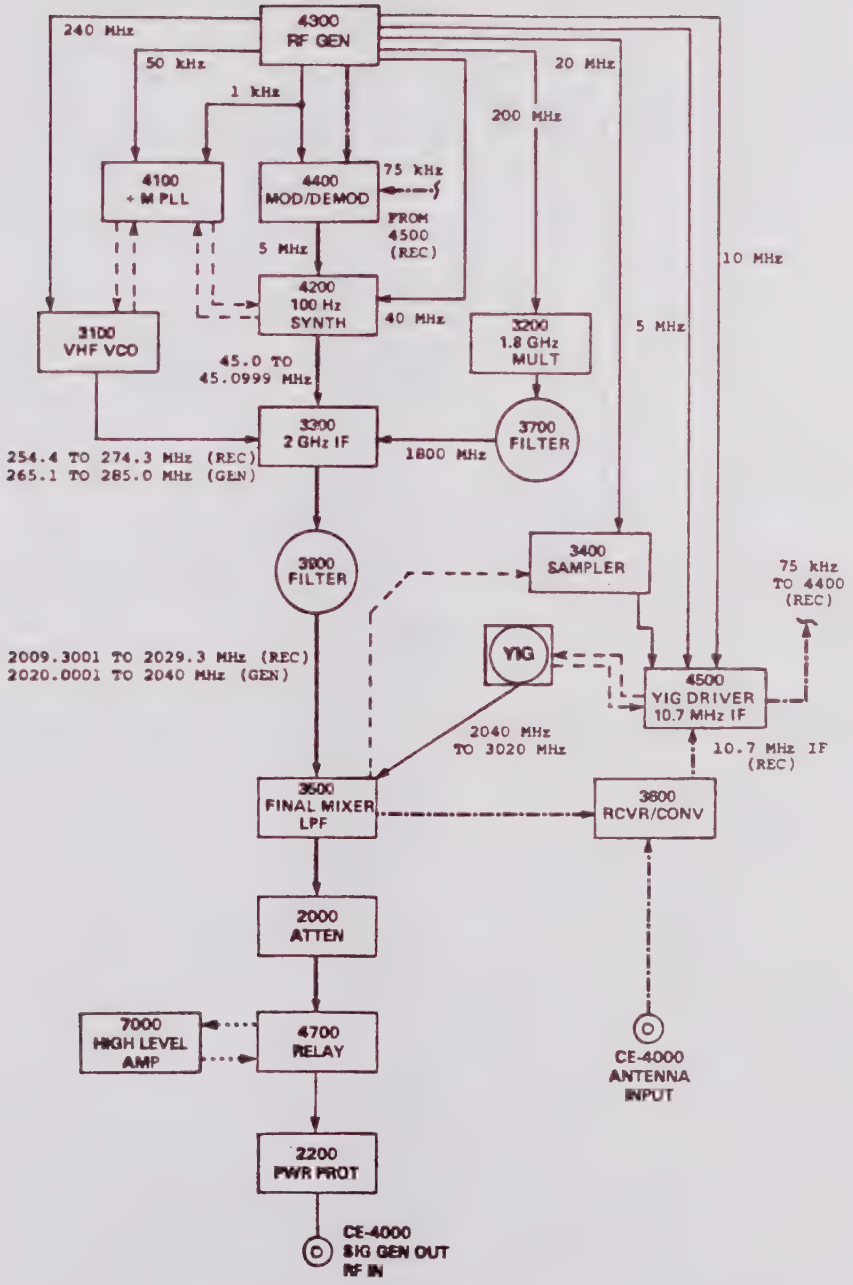
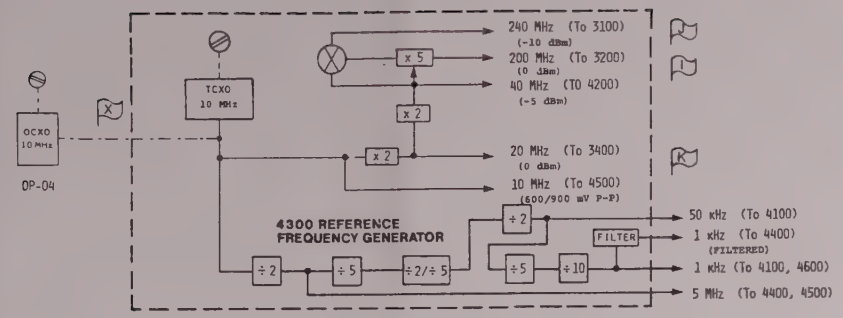


Figure 3-2. Signal Flow Diagram.



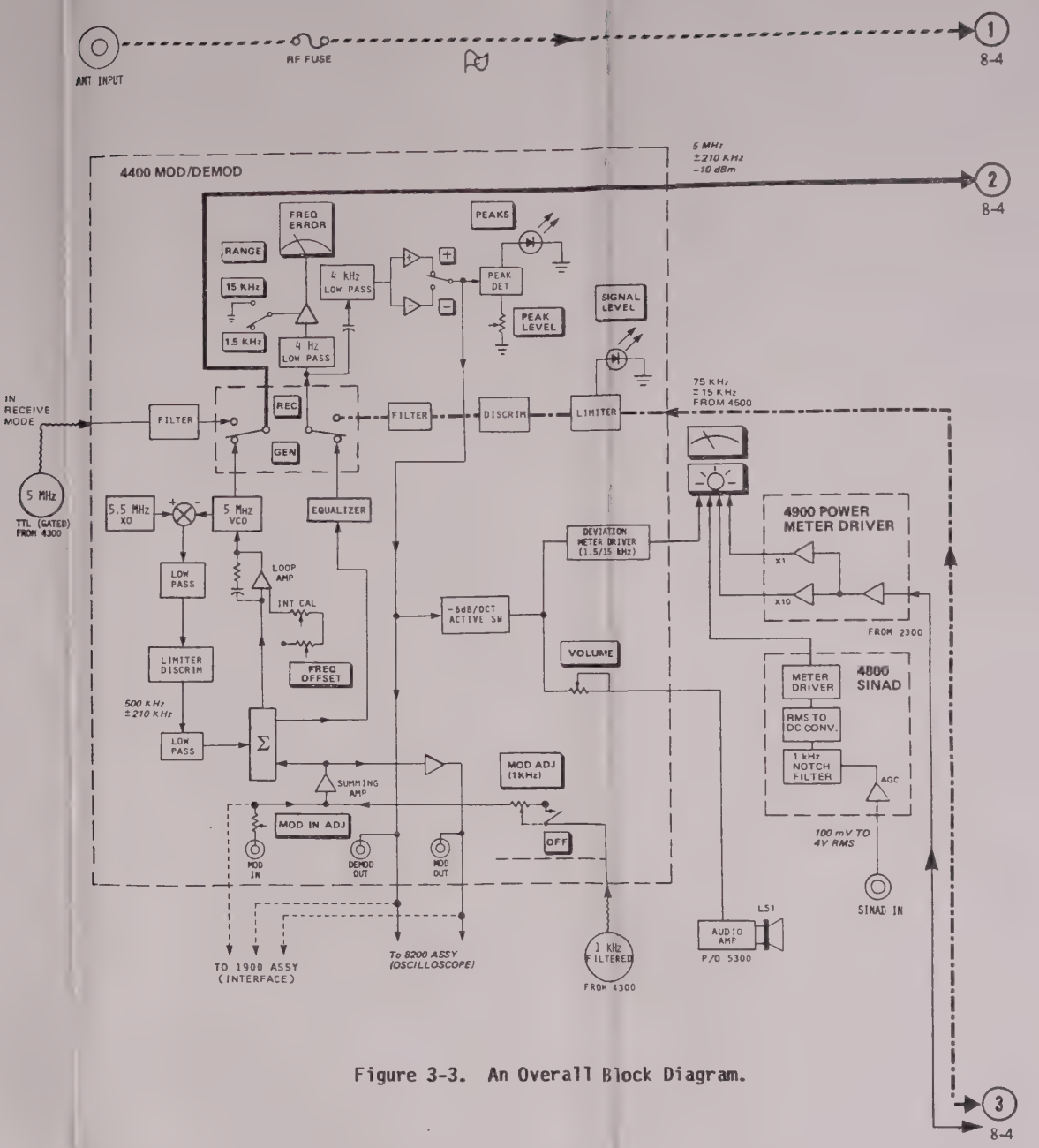


Figure 3-3. An Overall Block Diagram.

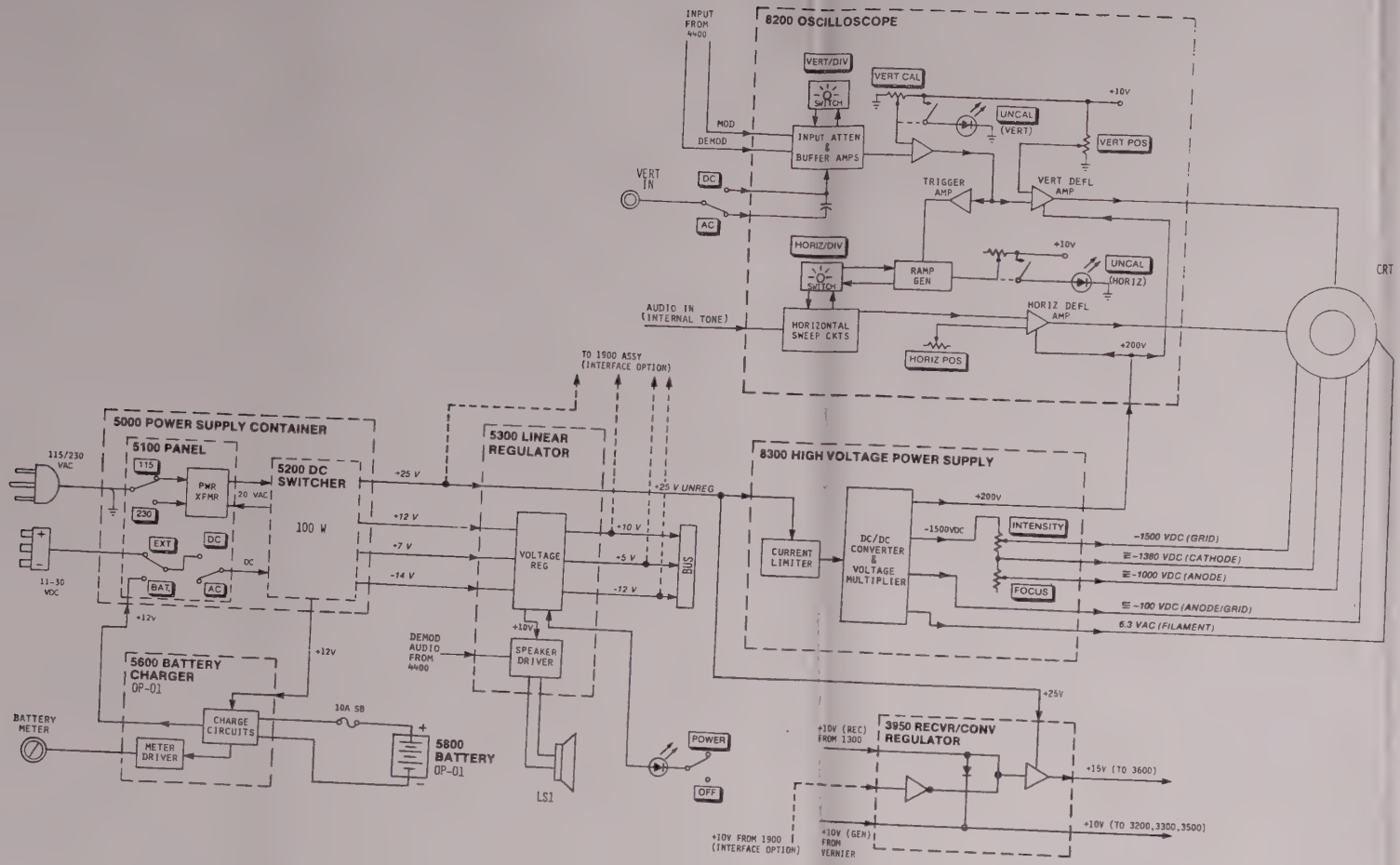


Figure 3-3. An Overall Block Diagram. (Continued)

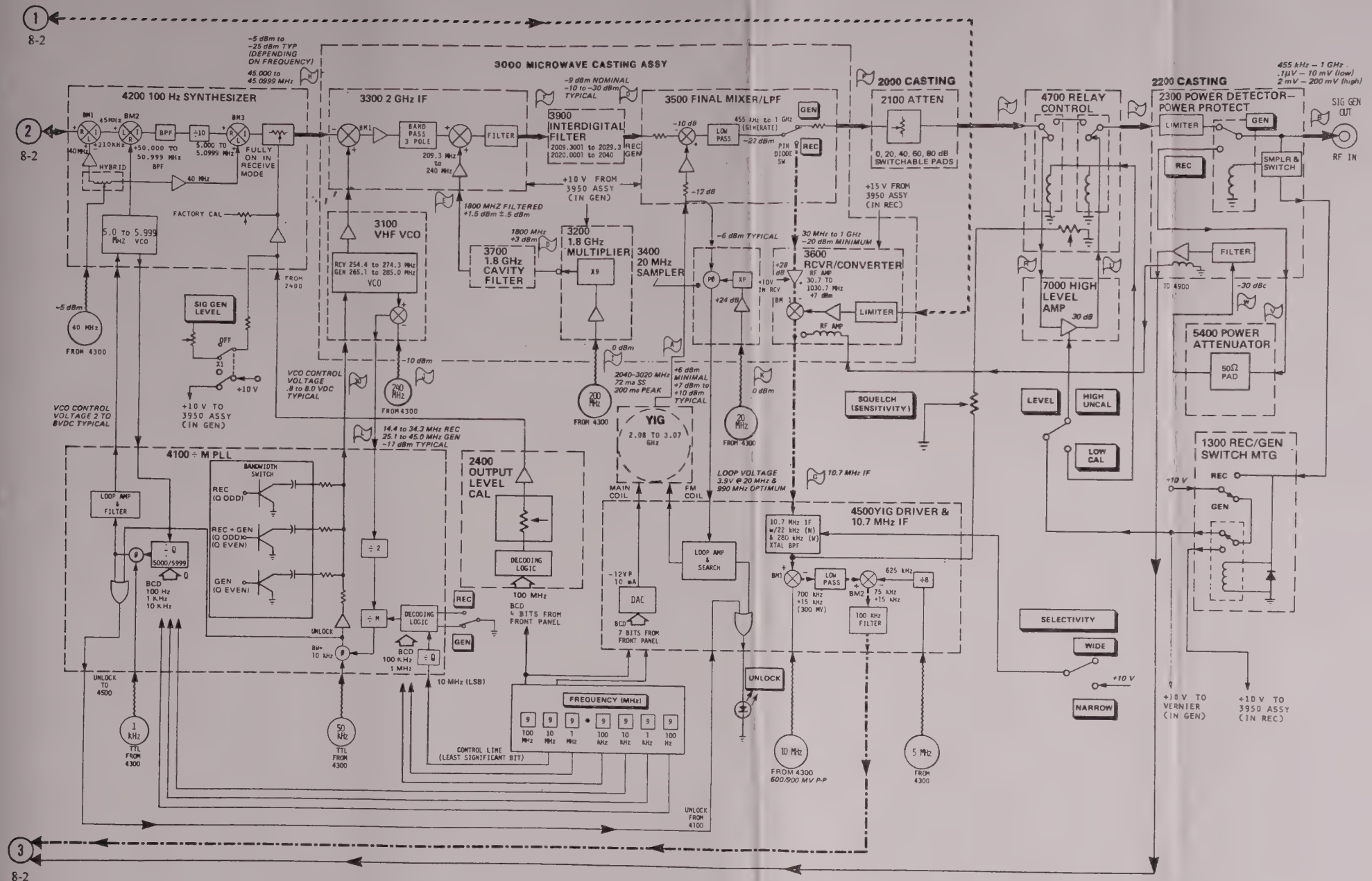


Figure 3-3. An Overal Block Diagram. (Concluded)

3.2.7 This output then goes to the microwave and VHF synthesizer in the main RF casting, where it is mixed and subtracted from a VHF/VCO frequency, determined by the setting of the front-panel frequency select switches.

3.2.8 After subtraction, the signal is filtered and mixed with 1.8 GHz to create the IF frequency, which is filtered and used as the RF input to the final mixer in the microwave casting.

3.2.9 In the final mixer, the phase-locked YIG frequency is mixed with the 2 GHz IF output frequency. The difference frequency is the output frequency dialed in on the front-panel FREQUENCY (MHz) switches.

GENERATE Mode

3.2.10 The modulation and frequency offset are controlled by a 5 MHz crystal Oscillator in the frequency modulation/demodulation section. The deviation scales of the Function Meter, the FREQUENCY ERROR Meter, and inputs to the oscilloscope are also controlled by this section.

3.2.11 The 5 MHz signal then goes to the low frequency synthesizer and higher frequency synthesizer sections described in paragraphs 3.2.5 through 3.2.9

3.2.12 The signal from the VHF synthesizer is then sent, in the GENERATE mode, to a step attenuator instead of the Receiver Converter section, as in the RECEIVE mode of operation. The attenuated signal may be amplified an additional 30dB before final output by positioning the front panel LEVEL switch to HIGH.

Frequency Synthesis

3.2.13 Frequency synthesis for the CE-4000 is accomplished by means of two crystal oscillators, three voltage controlled oscillators (VCO), and an yttrium-iron-garnet (YIG) oscillator.

3.2.14 All reference frequencies are derived from a 10 MHz crystal oscillator. In the standard version, this is a temperature compensated crystal oscillator (TCXO) on the 4300 Reference Frequency Generator Assembly. If Option 02 or Option 04 is installed, this is an oven controlled cystal oscillator (OCXO) connected to the 4300 Assembly by a coaxial cable.

3.2.15 Modulation frequencies in the CE-4000 are derived from a 5.5 MHz crystal oscillator and 5 MHz voltage controlled oscillator (VCO) on the 4400 Modulation/Demodulation Assembly.

3.2.16 A 5.0 MHz to 5.999 MHz VCO circuit on the 4200 10 Hz Synthesizer Assembly is used in low frequency synthesis.

3.2.17 Both the 4200 Assembly VCO and the 3100 Assembly VCO are controlled by the 4100 Divide-By-M Phase-Lock-Loop Assembly and the binary coded digits (BCD) from the front panel switches.

3.2.18 In the Signal Generate mode, the 4200 Assembly has a calibrated flat signal output controlled by the 2400 Output Level CAL Assembly. The 2400 Assembly is controlled by four bits selected from the 100 MHz binary coded digit on the front panel FREQUENCY (MHz) switches.

3.2.19 An yttrium-iron-garnet (YIG) oscillator operating from 2.04 GHz to 3.02 GHz is used to generate frequencies in the microwave range.

3.2.20 The YIG loop is controlled by the 3400 20 MHz Sampler and 4500 YIG Driver Assemblies which are controlled by the binary coded digits from the front panel FREQUENCY (MHz) switches.

3.2.21 Figure 3-2 illustrates the paths of the various frequencies used in the CE-4000.

Microwave Casting

3.2.22 The 3000 Microwave Casting Assembly contains six printed circuit board assemblies and a bandpass filter assembly used in the frequency generation process of the CE-4000.

3.2.23 The assemblies located within the casting are:

3100 VHF/VCO
3200 1.8 GHz Multiplier
3300 2 GHz IF
3400 20 MHz Sampler
3500 Final Mixer/Low Pass Filter
3600 Receiver/Converter

3.2.24 The casting is used in conjunction with the 3700 1.8 GHz Cavity Filter Assembly and the 3900 Interdigital Filter Assembly.

3.2.25 The 3300 2 GHz IF Assembly is located in the main RF casting. It subtracts the VHF/VCO frequency, filters, amplifies, and adds 1800 MHz to the modulated, encoded, and frequency compensated signal coming from the 4200 and 4400 Assemblies.

3.2.26 The 3900 Assembly is a three-pole interdigital bandpass filter that provides rejection of both the 1800 MHz local oscillator frequency and the image frequency. The filtered IF frequency then goes to the 3500 Final Mixer/Low Pass Filter Assembly.

3.2.27 The 3500 Final Mixer/Low Pass Filter Assembly performs several functions. It down-converts the YIG oscillator frequency with the IF frequency to create the output frequency. It provides a coupled signal from the YIG oscillator to the 3400 20 MHz Sampler Assembly to phase lock the YIG. It also switches the output from the Signal Generator port to the Receiver Local Oscillator port in the casting when the instrument is switched from GENERATE mode to RECEIVE mode.

Frequency Offset

3.2.28 The operating frequency of the CE-4000 is locked in 100 kHz increments and is offset 10.7 MHz between the RECEIVE and GENERATE modes. In the RECEIVE mode, the operating frequency is actually 10.7 MHz higher than the frequency dialed in on the front panel frequency select switch.

3.2.29 This offset frequency is used as the local oscillator signal in the 3600 Receiver/Converter Assembly where the incoming RF signal is limited, filtered, and mixed with the LO before being sent to the 10.7 MHz IF portion of the 4500 Assembly. The 10.7 MHz IF is filtered and subtracted from reference frequencies to yield a 75 kHz nominal output frequency.

3.2.30 The output frequency from the 4500 Assembly 10.7 MHz IF is exactly equal to the frequency selected on the front panel. This 75 kHz nominal is sent to a limiter, FM discriminator, and filter on the 4400 Assembly where the demodulated FM is processed for the various audio, metering, oscilloscope, and display circuitry.

Output Circuitry

3.2.31 In SIGNAL GENERATE mode, the output from the 3500 Assembly in the microwave casting is attenuated in 20dB steps by the 2100 Attenuator Assembly. The 2100 Assembly is located in the 2000 Attenuator Casting Assembly and is controlled by the SIG GEN LEVEL rotary switch and fine adjustment potentiometer on the front panel.

3.2.32 The 4700 Relay Control Assembly routes the attenuated signal from the 2000 Attenuator Casting to either the 7000 High Level Amplifier Assembly when the front panel LEVEL switch is in the HIGH (UNCAL) position, or directly to the 2200 Output Casting Assembly when the LEVEL switch is in the LOW (CAL) position. Circuitry on the 4700 Assembly also sets the range of the receiver sensitivity as controlled by the SQUELCH (SENSITIVITY) potentiometer on the front panel.

3.2.33 The 7000 High Level Amplifier Assembly increases the attenuated output signal 30dB when the front panel LEVEL switch is in the HIGH (UNCAL) position. The amplified signal is sent back to the 4700 Assembly where it is routed to the 2200 RF Output Casting.

3.2.34 The 2200 RF Output Casting contains the 2300 Power Detector/ Power Protector Assembly. The 2300 Assembly limits the attenuated high or low level generated signal prior to output at the SIG GEN OUT/RF IN port in the front panel. The 2300 Assembly also contains circuitry used in RF power measurement.

Displays

3.2.35 The CE-4000 contains display conversion circuitry for measuring transmitter power, SINAD, signal level, frequency error, peaks level, frequency deviation, audio, and for oscilloscope interface.

RF Power

3.2.36 Transmitter output power is received through the SIG GEN OUT/RF IN connector on the front panel and routed via coaxial cable to the 2200 RF Casting Assembly.

3.2.37 The 2300 Power Detector/Power Protector Assembly in the 2200 Casting automatically switches the 1300 RECEIVER/GENERATE Switch Mounting Assembly on the front panel to RECEIVE mode. It also sends the incoming signal to the 5400 Power Attenuator Assembly. A thermal sensor on the 5400 Assembly sounds an alarm when output power reaches 150W for more than five minutes.

3.2.38 The RF signal returns to the 2300 Assembly where it is filtered and buffered before being sent to the 4900 Power Meter Driver Assembly. The 4900 Assembly and the front panel function switch are used to select and drive the two ranges of power measurement displayed on the front panel Function Meter.

SINAD

3.2.39 A signal for receiver sensitivity measurements (SINAD) is input to the CE-4000 front panel SINAD IN connector and sent to the 4800 SINAD Assembly, which is mounted on the outside cover of the microwave casting on the left side of the main chassis. The signal is detected, filtered, and converted on the 4800 Assembly before going to the front panel Function Meter switch for selection and display on the Function Meter SINAD scale.

Modulation/Demodulation

3.2.40 Display processing of the complex signal under test is accomplished by the 4400 Modulation/Demodulation Assembly. Signal detection and display drive circuitry for the FREQUENCY ERROR Meter, for the two ranges of frequency deviation on the Function Meter, and for the peaks LED, are all part of the 4400 Assembly.

3.2.41 The 4400 Assembly also provides audio information to the speaker driver circuitry in the 5300 Assembly and modulated or demodulated input to the 8200 Oscilloscope Assembly.

Oscilloscope

3.2.42 The 8200 Oscilloscope Assembly contains the circuits required to amplify and display the 4400 Assembly modulation, demodulation, and audio, or an external source signal, to the levels needed to transform the signal into a representative visual display on the cathode ray tube (CRT).

3.2.43 The 8200 Assembly also contains circuits for controlling the CRT functions and the position and display of the signal characteristics on the CRT. Voltages required to drive the CRT are provided by the 8300 High Voltage Power Supply Assembly.

Power Supply and Audio

3.2.44 The Power Supply Container Assembly is located in the rear panel and activated by controls on the front and rear panels. The 5000 Assembly contains the 5100 Panel Assembly and the 5200 Switching Power Supply Assembly. The 5100 Panel Assembly contains the switches for selecting either 115V AC or 230V AC and 11 to 30V DC source power inputs for the 5200 Assembly in the standard version. Operating voltages required for the different functions are controlled by the 5300 Linear Regulator Assembly attenuator.

3.2.45 Power from the 5000 Assembly to the 3000 Microwave Casting Assembly is controlled by the 1300 RECEIVE/GENERATE Switch Mounting Assembly and the 3950 Receiver Converter Regulator Assembly. When the CE-4000 is in RECEIVE mode, power is supplied to the 3600 Receiver Converter Assembly. When the SIG GEN LEVEL switch is turned on, power is supplied to the 3200, 3300, and 3500 Assemblies. Power to the YIG sampler and VHF/VCO Assemblies is continuous.

3.2.46 The audio amplifier which receives audio information from the 4400 Assembly is located on the 5300 Assembly. The audio amplifier drives a loudspeaker mounted on the chassis of the CE-4000 and the speaker loudness is adjusted by the volume control on the front panel.

Option 01, Battery

3.2.47 The OP-01 feature allows the user to select, with a rear panel switch, either a 12V DC Battery, an external 11V to 30V DC power supply, or one AC power source, either 115V or 230V AC. The battery charger is operational whenever the instrument is plugged-in to an AC or DC external power source and BATTERY/EXT switch on the rear panel is in the EXT position.

Option 02, OCXO

3.2.48 The OP-02 OCXO uses an oven controlled crystal oscillator mounted on the rear of the main chasis. The OCXO generates a highly accurate and stable 10 MHz time base signal which is sent to the 4300 Reference Frequency Generator Assembly by a coaxial cable.

Option 03, Tone Synthesizer

3.2.49 The OP-03 Tone Synthesizer uses a reference signal from the 4300 Assembly as a clock for a programmable rate counter. The programmable rate counter outputs a tone selected by the front panel switches to the 4400 Assembly.

Option 04, Simulcast Paging

3.2.50 The OP-04 Simulcast Paging feature adds two digital liquid crystal displays, an IF counter and an audio power meter to aid in simulcast paging set-up and repair. The IF counter uses a fixed 1 second gate and shows a five digit Mantissa with 1 Hz as the least signficant digit to show the frequency difference between the selected and signal frequencies.

CIRCUIT CARD DESCRIPTION

3.3 The following paragraphs decribe the CE-4000 circuit card assemblies. A block diagram of the circuit card follows each paragraph.

RECEIVE/GENERATE Switch Assembly (1300)

3.3.1 A block diagram of the 1300 assembly is shown in Figure 3-4 below. Assembly 1300 switches 10 volt power from the Receive bus and the high-gain amplifier to the LEVEL switch when Assembly 2300 is activated by a power level in excess of -23dBm. Relay K1 is de-energized by removal of 10 volts from Assembly 2300 to pin 10. The 10 volt power is removed from pins 8 and 9 and applied to pins 5 and 11.

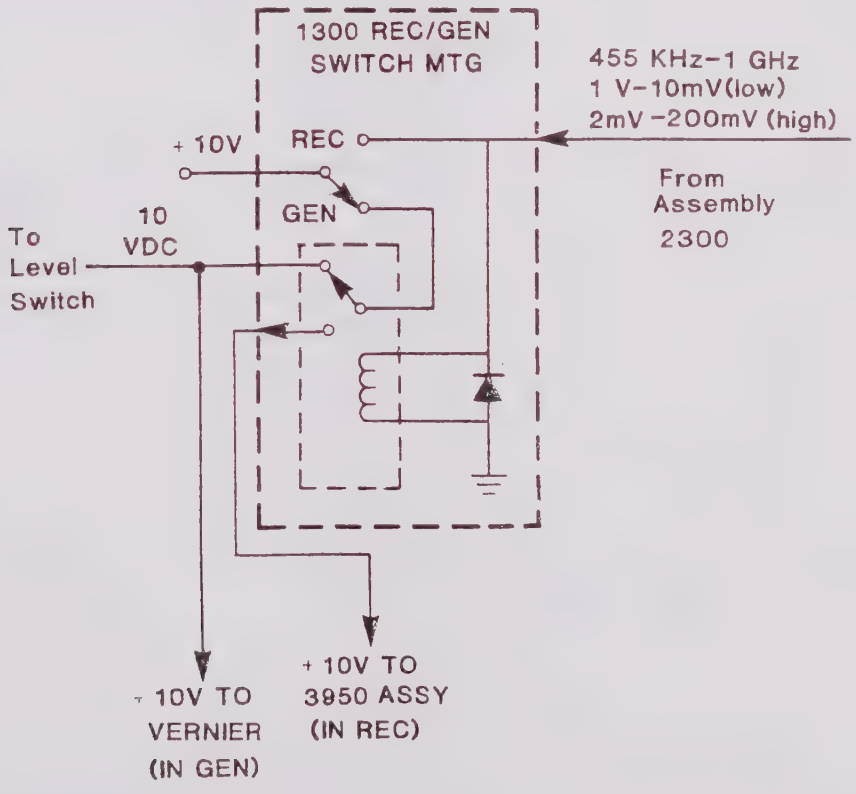


Figure 3-4. RECEIVE/GENERATE Switch Assembly (1300).

Attenuator Assembly (2100)

3.3.2 A block diagram of the 2100 assembly is shown in Figure 3-5 below. In the GENERATE mode, the output from the 3500 Assembly is attenuated in 10dB steps, for a total attenuation of 80dB. The attenuated output is then routed through the 4700 Relay Assembly.

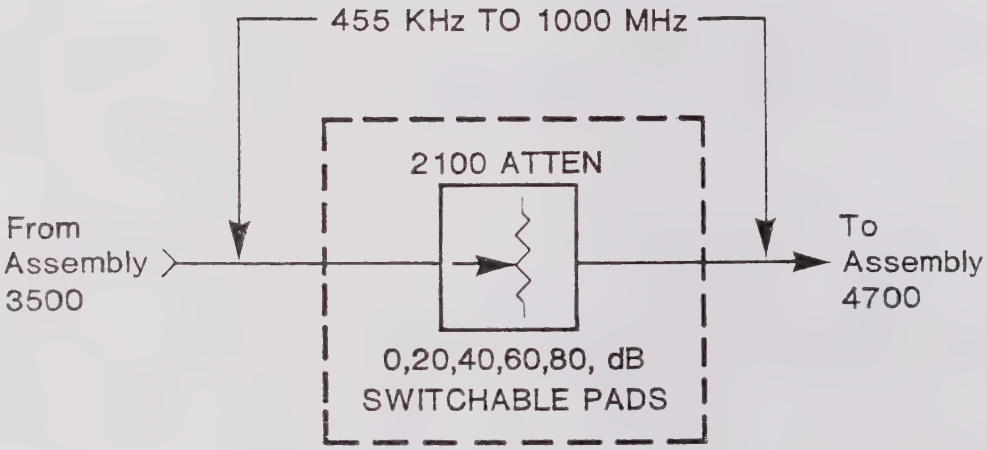


Figure 3-5. Attenuator Assembly (2100).

Power Detection/Protection (2300)

3.3.3 A block diagram of the 2300 Assembly is shown in Figure 3-6 below. Assembly 2300 contains power detection and protection circuits which, when activated, protect the CE-4000 when power is applied through the RF IN connector. Circuitry used in RF power measurements is also included on the 2300 Assembly.

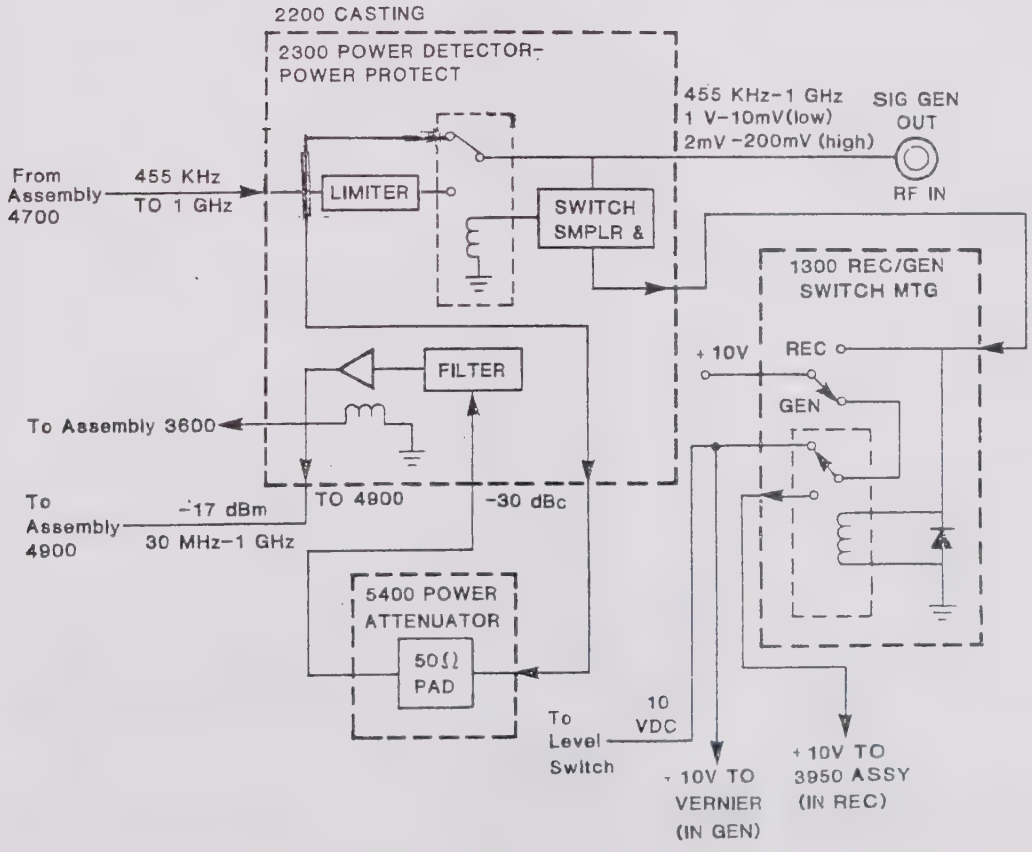


Figure 3-6. Power Detection/Protection (2300).

Output Level Calibration (2400)

3.3.4 A block diagram of the 2400 Assembly is shown in Figure 3-7 below. The 2400 Assembly converts BCD binary values of the 100 MHz switch section of the FREQUENCY (MHz) switches, to analog voltages that are applied to Assembly 4200.

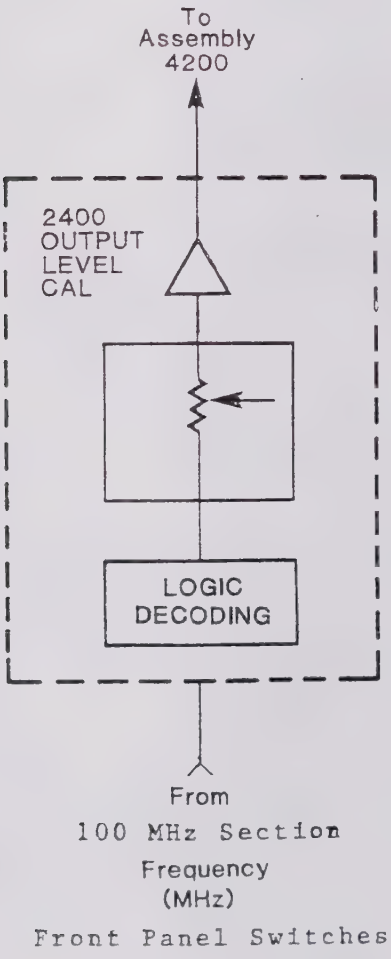


Figure 3-7. Output Level Calibration (2400).

VHF VCO (3100)

3.3.5 A block diagram of the 3100 Assembly is shown in Figure 3-8 below. The 3100 Assembly generates a 254.4 to 285.0 MHz frequency band and a 14.4 to 45 MHz frequency band, using a voltage-controlled oscillator (VCO). The VCO output is distributed through a buffer amplifier to a mixer, where it is mixed with 240 MHz applied through pin 1. Lowpass filter circuitry associated with the amplifier provides a frequency range output of 14.4 to 34.4 MHz in the RECEIVE mode, and 25.1 to 45.0 MHz in the GENERATE mode. The 14.4 to 45 MHz signal is used as part of a phase-locked-loop assembly.

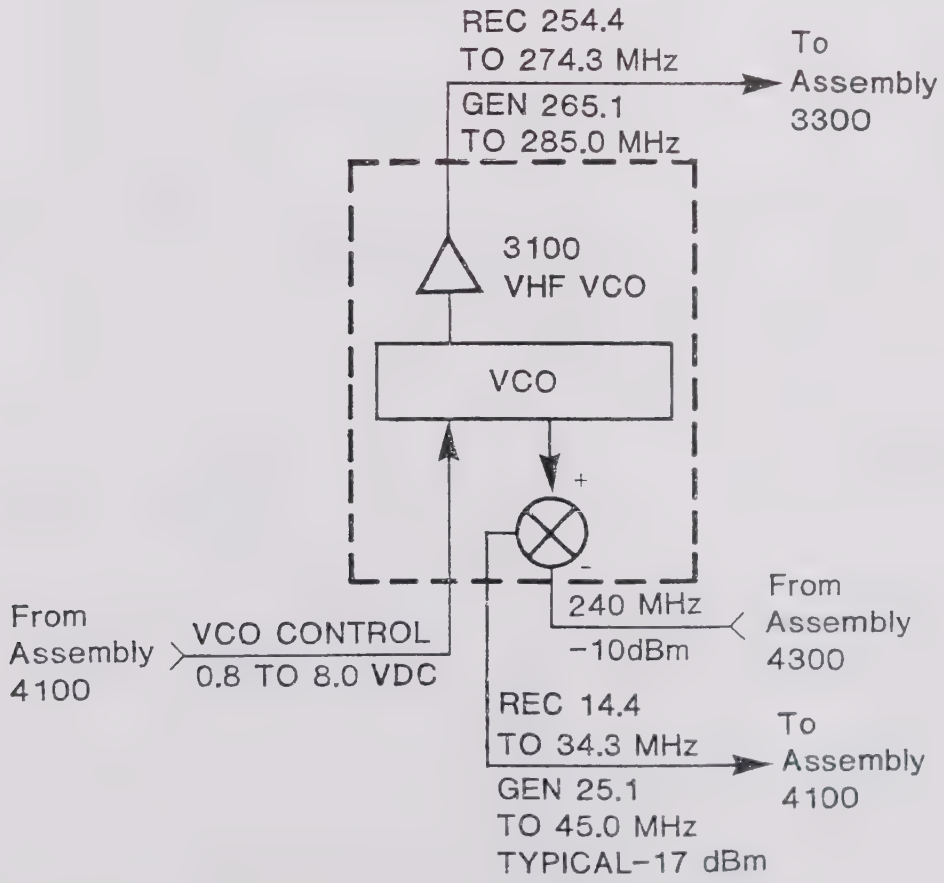


Figure 3-8. VHF VCO (3100).

1.8 GHz Multiplier

3.3.6 A block diagram of the 3200 Assembly is shown in Figure 3-9 below. The 3200 Assembly receives a 200 MHz frequency from the 4300 Assembly (Reference Frequency Generator). Filter circuitry suppresses all frequencies except the 200 MHz. A harmonics generator then generates harmonic multiples of the 200 MHz primary frequency. Filter circuitry then suppresses all harmonics except the 9th, at 1.8 GHz.

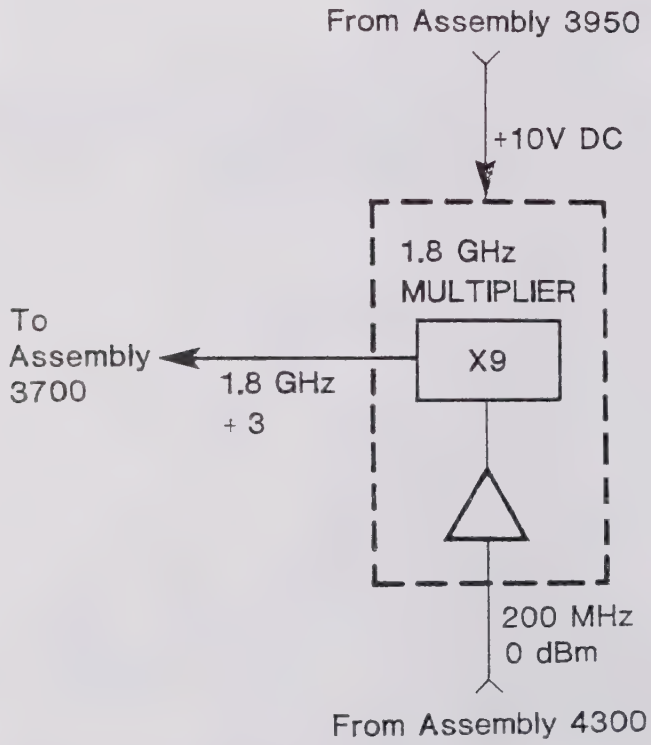


Figure 3-9. 1.8 GHz Multiplier (3200).

2 GHz IF (3300)

3.3.7 A block diagram of the 3300 Assembly is shown in Figure 3-10 below. The 3300 Assembly subtracts 45 MHz from the VHF/VCO frequency, filters, amplifies, and adds 1800 MHz to the modulated, encoded, and frequency-compensated signal coming from the 4200 and 4400 Assemblies.

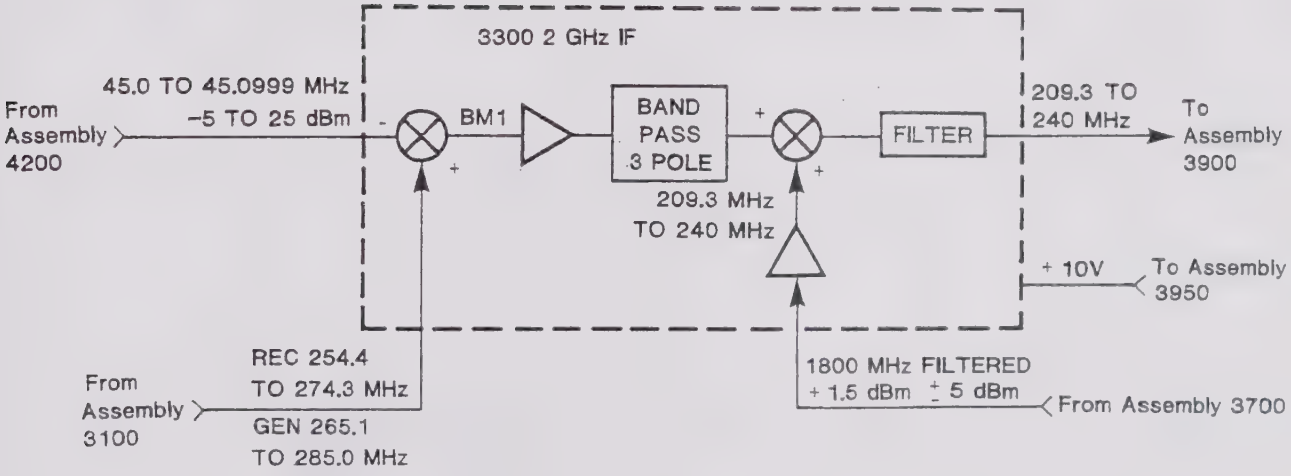


Figure 3-10. 2 GHz IF (3300).

20 MHz Sampler (3400)

3.3.8 A block diagram of the 3400 Assembly is shown in Figure 3-11 below. The 3400 Assembly generates a voltage in 20 MHz steps over the range of 2.08 to 3.07 GHz. This voltage is phase compared with the output of the YIG Assembly to produce a DC voltage. The DC voltage is used to phase-lock the YIG.

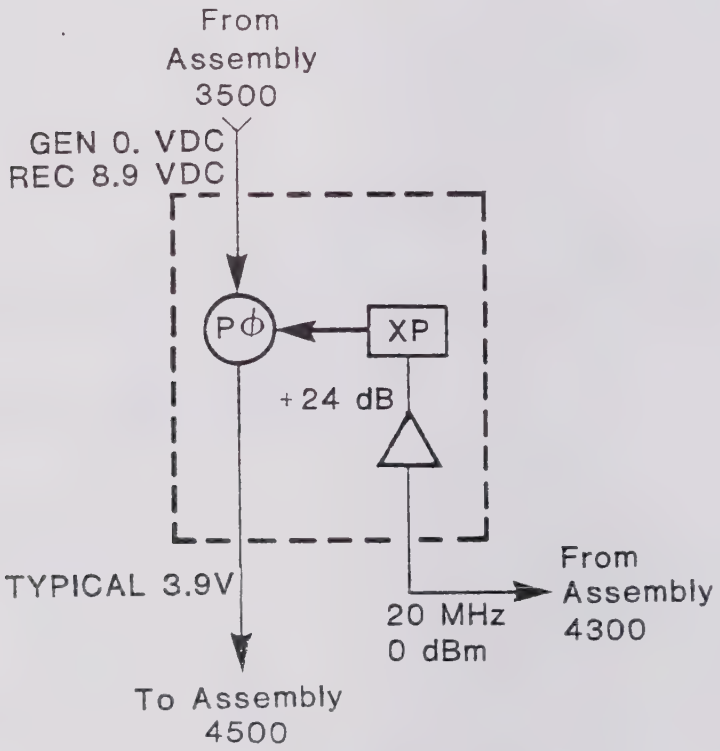


Figure 3-11. 20 MHz Sampler (3400).

Final Mixer/Low Pass Filter (3500)

3.3.9 A block diagram of the 3500 Assembly is shown in Figure 3-12 below. The 3500 Assembly performs several functions. It down- converts the YIG oscillator frequency with the IF frequency to create the output frequency. It provides a coupled signal from the YIG oscillator to the 3400 Assembly to phase-lock the YIG. It also switches the output from the signal generator port in the casting when the instrument is switched from GENERATE mode to RECEIVE mode.

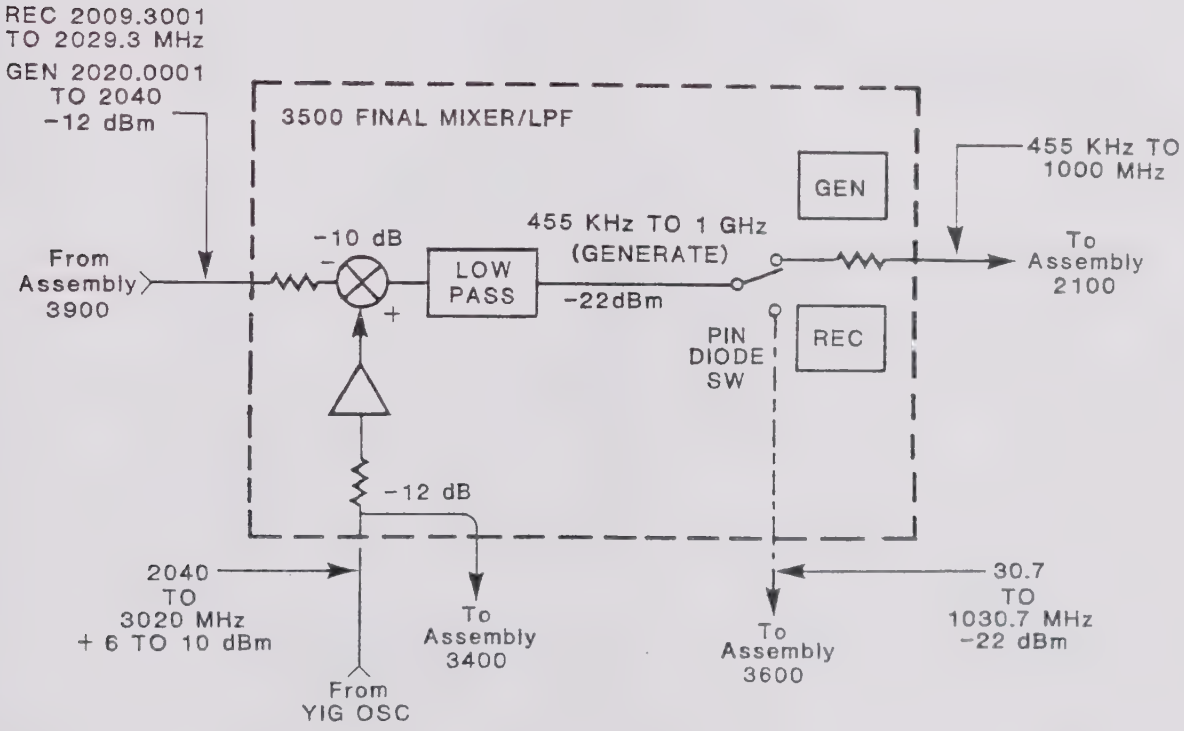


Figure 3-12. Final Mixer/Low Pass Filter (3500).

CE-4000

Receiver/Converter (3600)

3.3.10 A block diagram of the 3600 Assembly is shown in Figure 3-13 below. The 3600 Assembly converts RF signals received from the antenna, to a 10.7 MHz IF frequency when the CE-4000 is operating in the RECEIVE mode. The 10.7 MHz is sent to the 4500 Assembly where it is filtered and subtracted from reference frequencies to yield a 75 kHz nominal output frequency.

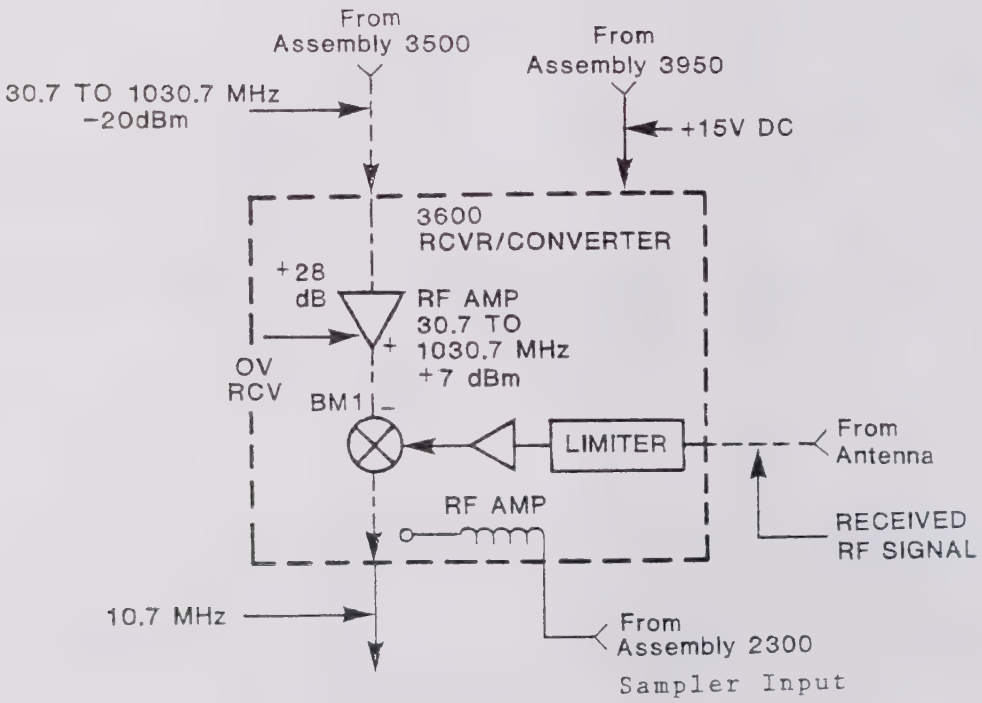


Figure 3-13. Receiver/Converter (3600).

1.8 GHz Cavity Filter (3700)

3.3.11 A simplified diagram of the 3700 Assembly is shown in Figure 3-14 below. The 1.8 GHz Cavity Filter consists of a tunable cylindrical cavity having a narrow passband of approximately 4 kHz. The 1.8 GHz signal from the 3200 Assembly is inductively coupled through a wire loop insertion probe.

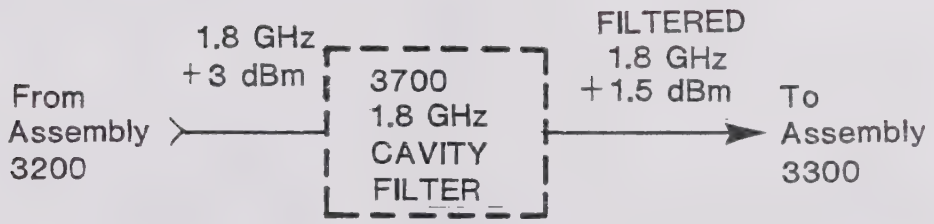


Figure 3-14. 1.8 GHz Cavity Filter (3700).

Interdigital Filter (3900)

3.3.12 A simplified diagram of the 3900 Assembly is shown in Figure 3-15 below. The 3900 Assembly is a 3-pole, interdigital bandpass filter that provides rejection of both the 1800 MHz local oscillator frequency and the image frequency. The filtered IF frequency is then passed on to the Final Mixer/Low Pass Filter Assembly (3500).

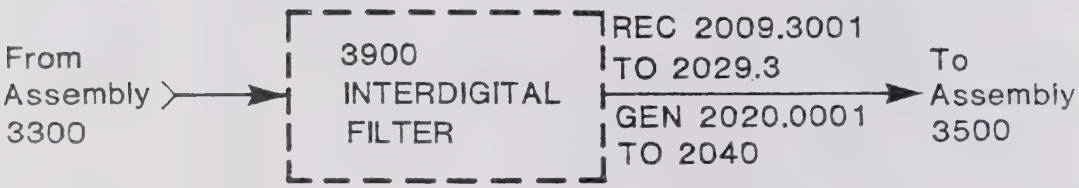


Figure 3-15. Interdigital Filter (3900).

Receiver Converter Regulator (3950)

3.3.13 A block diagram of the 3950 Assembly is shown in Figure 3-16 below. The 3950 Assembly provides regulated 15V DC to Assembly 3600, and regulated 10V DC to Assemblies 3200, 3300, and 3500.

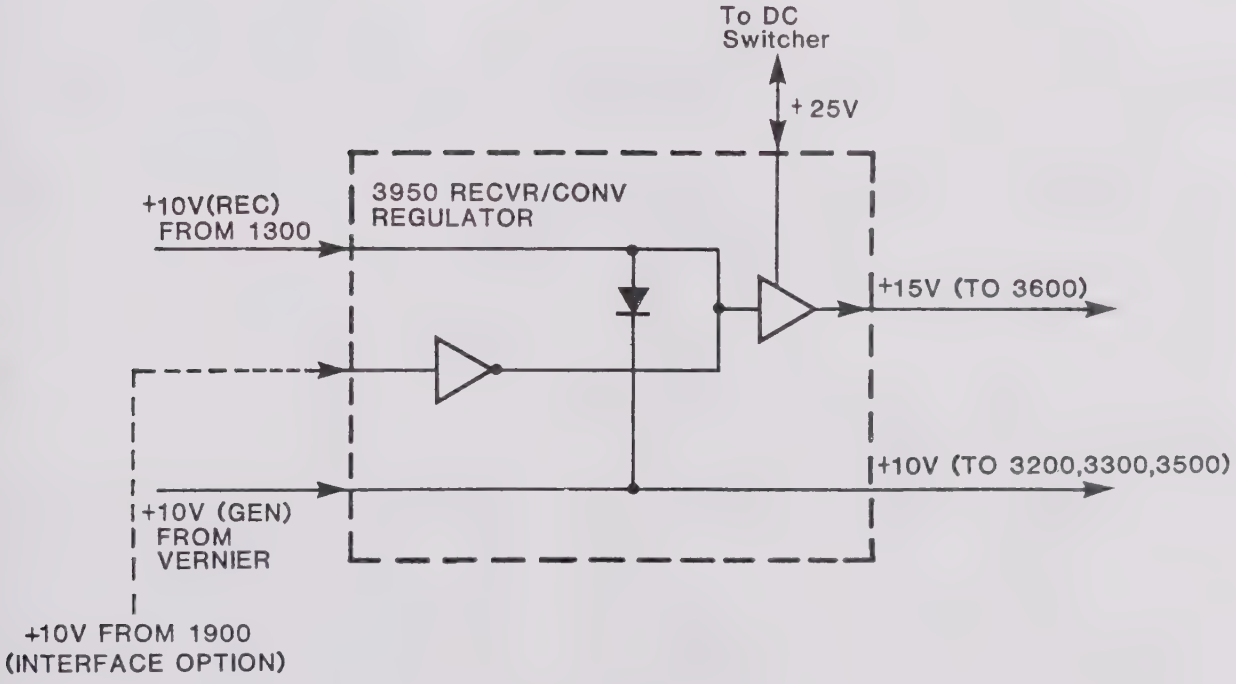


Figure 3-16. Receiver Converter Regulator (3950).

Divide-By-M PLL (4100)

3.3.14 A block diagram of the 4100 Assembly is shown in Figure 3-17 below. The 4100 Assembly converts digital inputs from the FREQUENCY (MHz) switches to analog control voltages for VCOs on Assemblies 3100 and 4200. This assembly is part of the VHF/VCO phase-lock-loop and the 5.0 to 5.499 MHz phase-lock-loop.

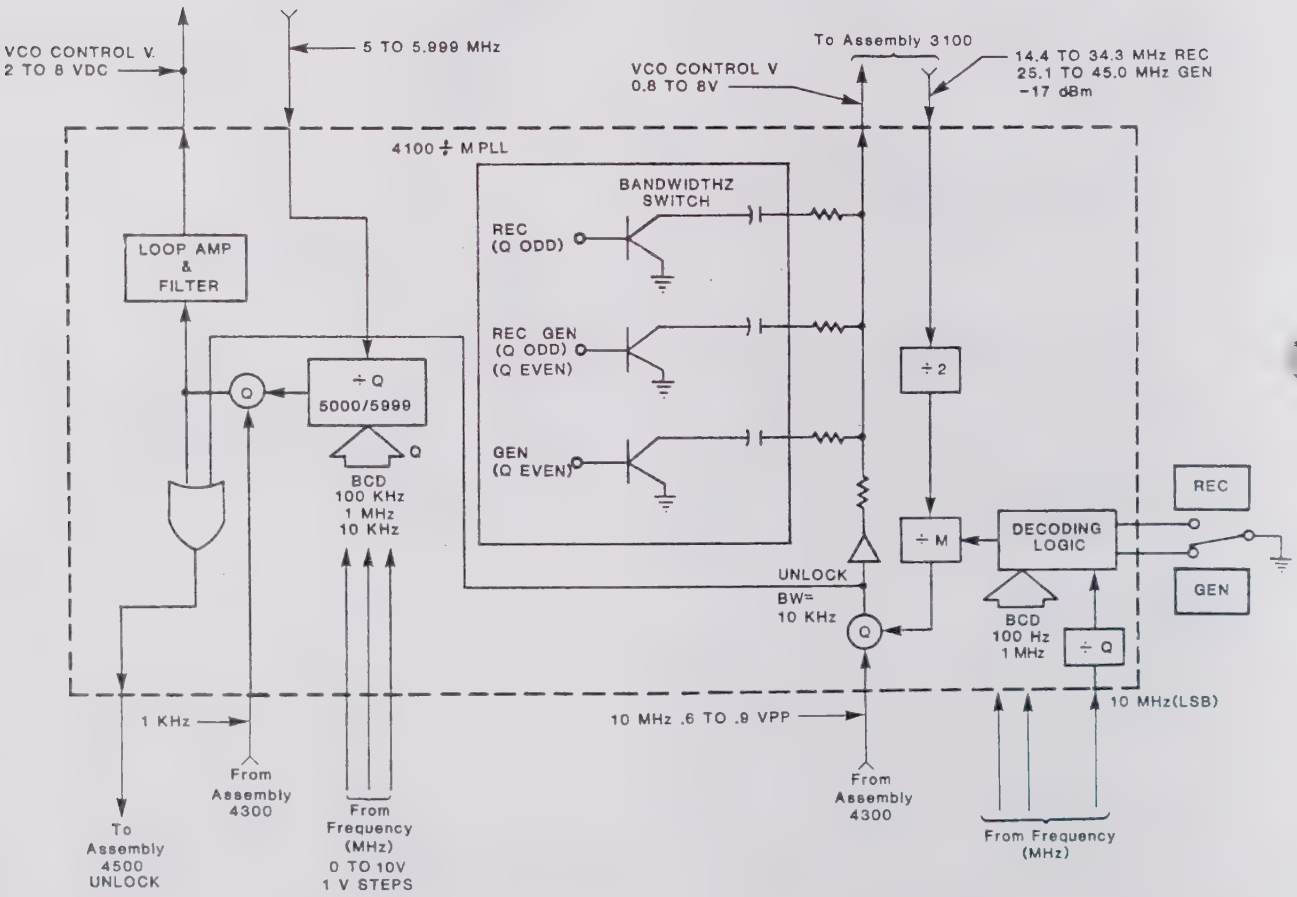


Figure 3-17. Divide-By-M PLL (4100).

100 Hz Synthesizer (4200)

3.3.15 A block diagram of the 4200 Assembly is shown in Figure 3-18 below. The 4200 Assembly uses a 5.0 to 5.999 MHz VCO circuit for low frequency synthesis. The 100 Hz Synthesizer is the first stage of the frequency synthesizing process. In the RECEIVE mode a 5 MHz frequency is applied to the 4200 Assembly from the Reference Generator on the 4300 Assembly through the 4400 Assembly. The 5 MHz is generated on the 4400 board in GENERATE mode.

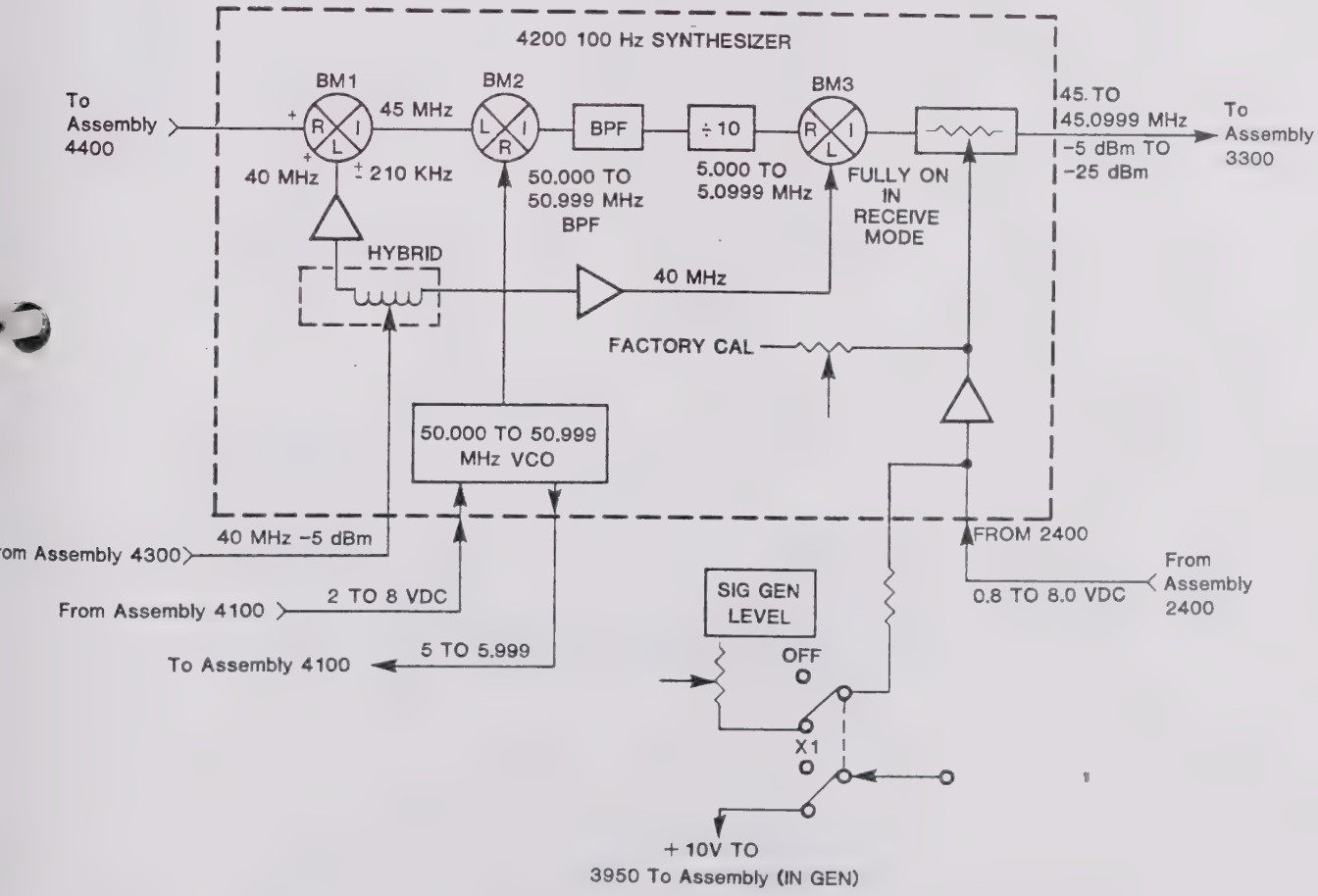


Figure 3-18. 100 Hz Synthesizer (4200).

Reference Frequency Generator (4300)

3.3.16 A block diagram of the 4300 Assembly is shown in Figure 3-19 below. The 4300 Assembly generates all of the reference frequencies, which are derived from a 10 MHz crystal oscillator. In the standard version, this is a temperature compensated crystal oscillator (TCXO). If Option 02 or Option 04 is installed, this is an oven controlled crystal oscillator (OCXO) connected to the 4300 Assembly by coaxial cable.

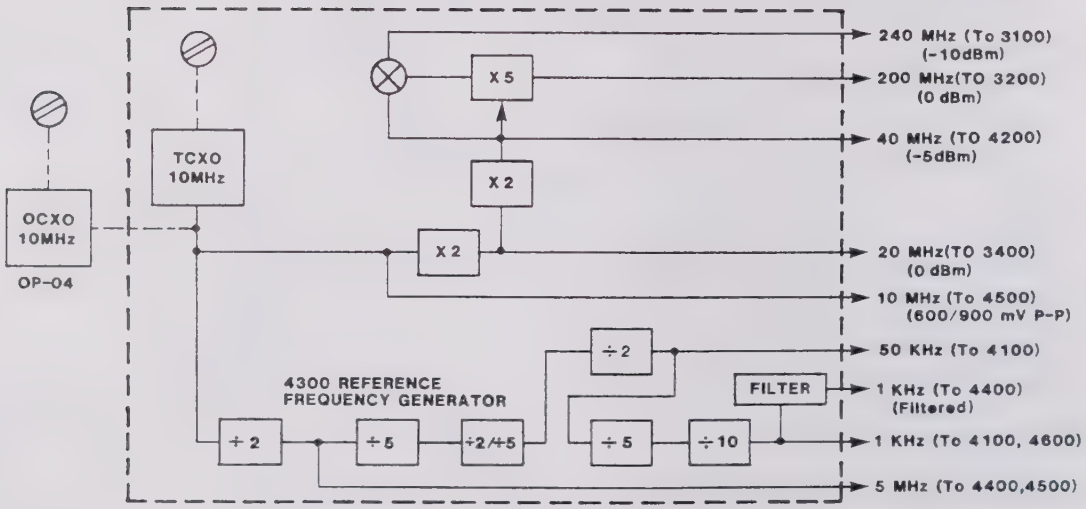


Figure 3-19. Reference Frequency Generator (4300).

MOD/DEMOD (4400)

3.3.17 The signal path for either the GENERATE mode or the RECEIVE mode begins on the 4400 Assembly diagramed in Figure 3-20. This assembly contains frequency modulation and demodulation circuitry controlled by an Automatic Frequency Controlled (AFC) loop. It also contains circuitry for the FREQUENCY ERROR Meter, Function Meter, and PEAK detector. In the GENERATE mode, a 5.5 MHz crystal oscillator provides a stable frequency reference that is mixed with a 5 MHz VCO. The VCO operates from the AFC loop, where frequency offset and modulation are added for the signal generator functions. In the RECEIVE mode, 75 kHz ±15 kHz FM signal is input from the 4500 Assembly through a limiter circuit to a discriminator that drives the signal-level LED. Internal or external modulation entering the assembly is buffered and attenuated through one of two paths selected by the RANGE switch. It is then amplified and split between the MOD OUT jack and a buffer amplifier that routes the modulation to the summing junction. At the summing junction, the modulation is added as an AC component on the DC signal.

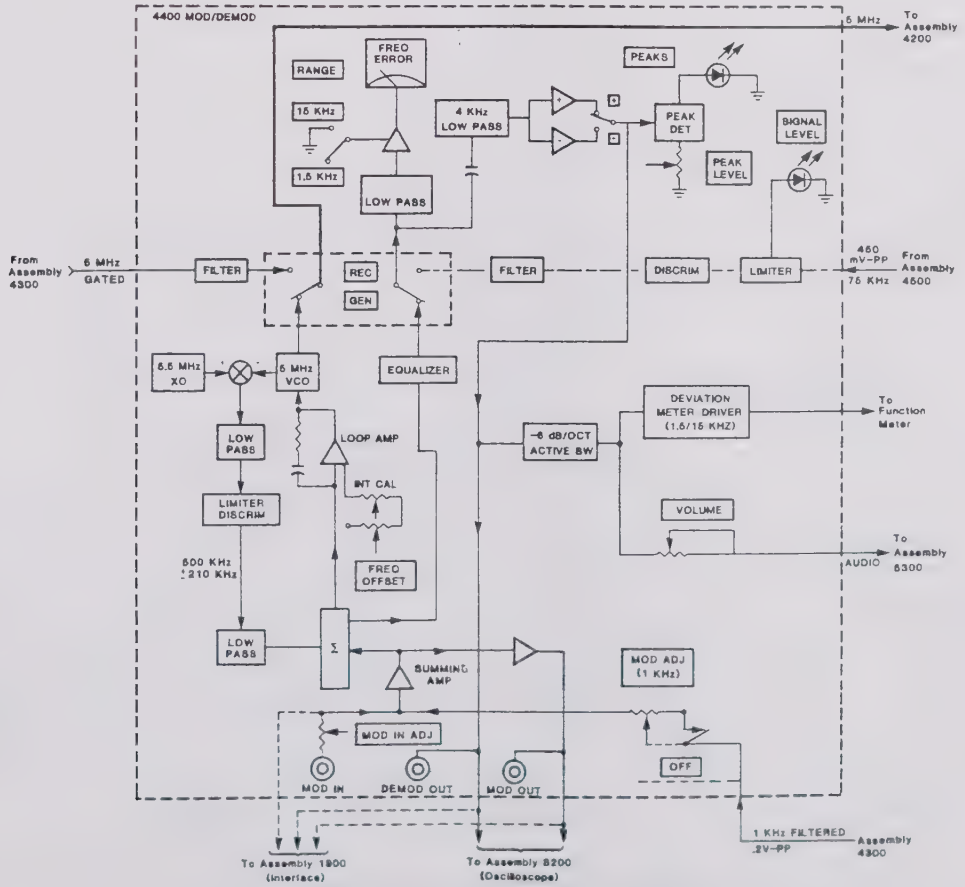


Figure 3-20. MOD/DEMOD (4400).

YIG Driver and 10.7 MHz IF (4500)

3.3.18 A block diagram of the 4500 Assembly is shown in Figure 3-21 below. The 4500 Assembly contains two independent circuits. One circuit converts the 10.7 MHz IF from the 3600 Assembly, while the other circuit provides tuning for the YIG oscillator.

3.3.19 The mixed and LO frequencies are sent to a 10.7 MHz crystal bandpass filter, where the signal is amplified, filtered, limited, and mixed with a 10 MHz reference frequency.

3.3.20 The 10 MHz reference frequency is subtracted from the 10.7 MHz IF to produce 700 kHz; a 625 kHz reference frequency is subtracted from this signal to produce the nominal 75 kHz output frequency.

3.3.21 The 75 kHz output frequency is sent to a frequency modulation discriminator and is presented as an audible signal and front panel meter displays.

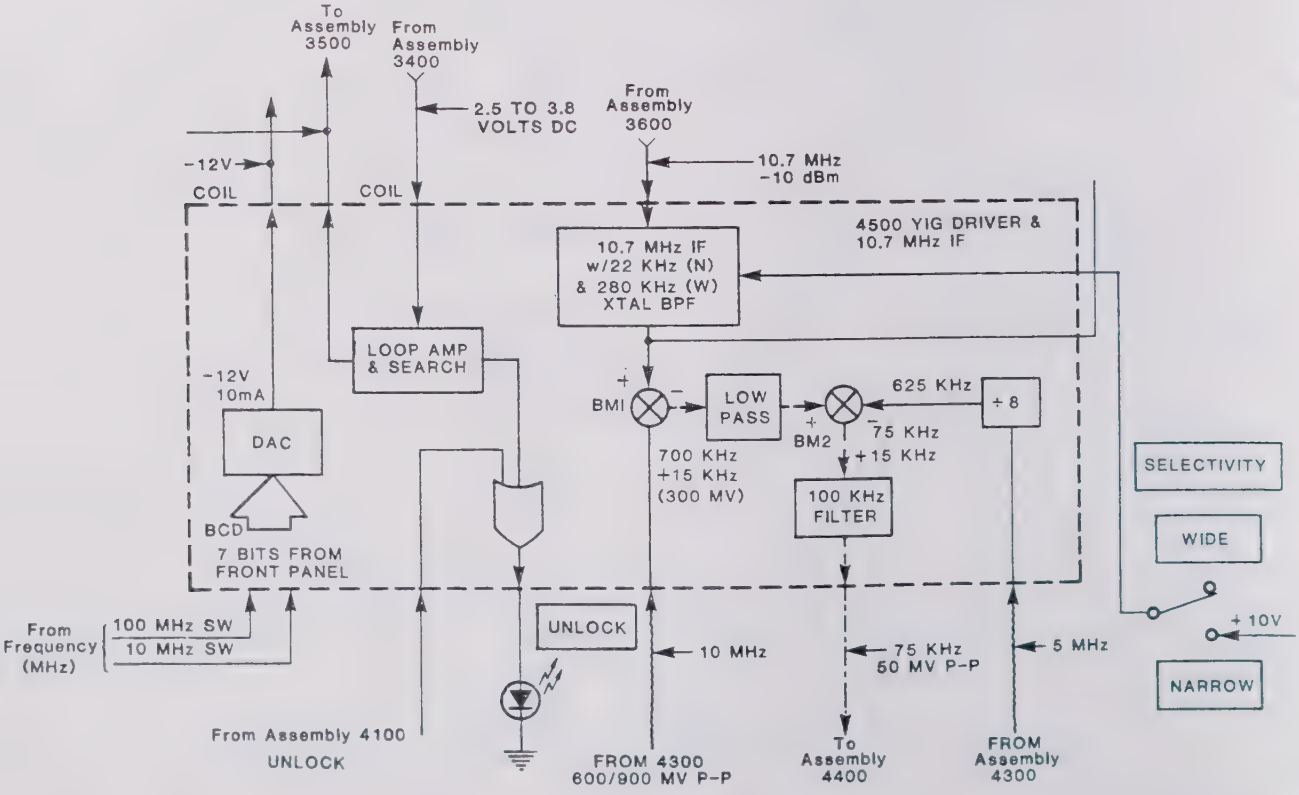


Figure 3-21. YIG Driver and 10.7 MHz IF (4500).

Relay Control (4700)

3.3.22 A block diagram of the 4700 Assembly is shown in Figure 3-22 below. The 4700 Assembly functions as an output power control circuit that applies RF power directly from the 2100 Assembly to the 2300 Assembly, or reroutes RF power from Assembly 2100 through a 30dB amplifier to the 2300 Assembly.

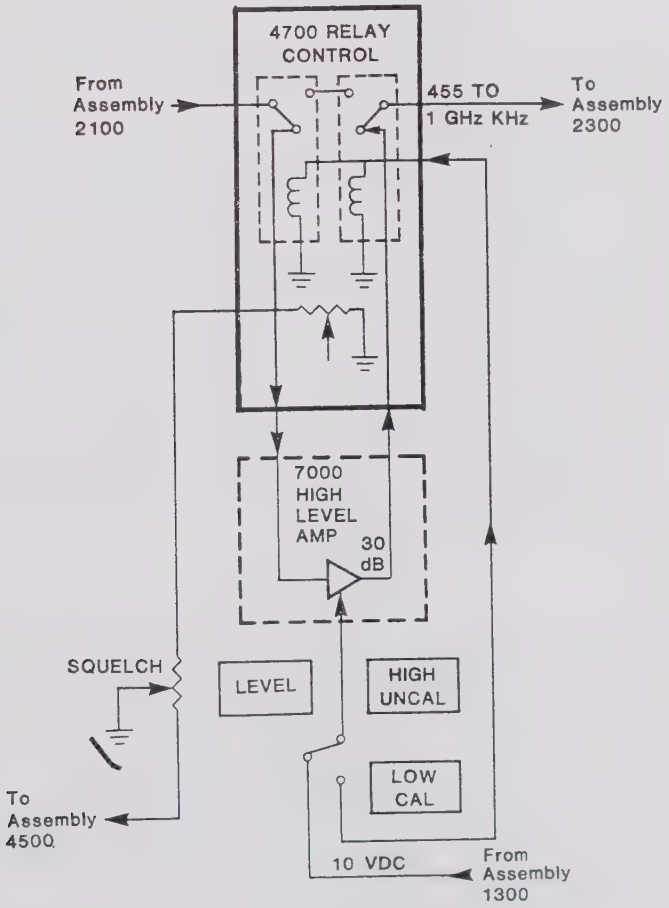


Figure 3-22. Relay Control (4700).

SINAD (4800)

3.3.23 A block diagram of the 4800 Assembly is shown in Figure 3-23 below. The 4800 Assembly determines the signal, noise, and distortion characteristics of a signal. Mathematically stated: SINAD = (Signal + Noise + Distortion) ÷ (Noise + Distortion). Noise and 1 kHz signals are AGC signals. The 1 kHz is passed through a notch filter leaving only noise and distortion. This signal is modulated and converted to LOG for display on the Function Meter.

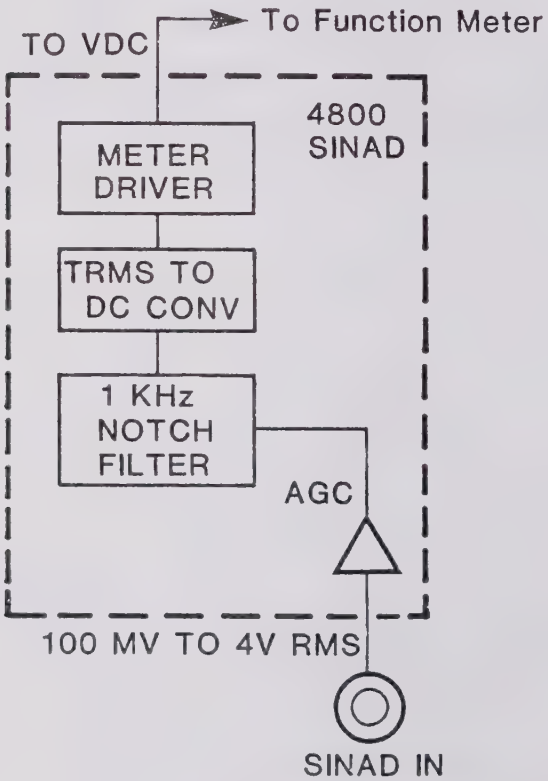


Figure 3-23. SINAD (4800).

Power Meter Driver (4900)

3.3.24 A block diagram of the 4900 Assembly is shown in Figure 3-24 below. The two power measurement ranges of the CE-4000 are 15W and 150W. The Power Meter Driver Assembly contains the circuitry required to select and drive the Function Meter for these two scales.

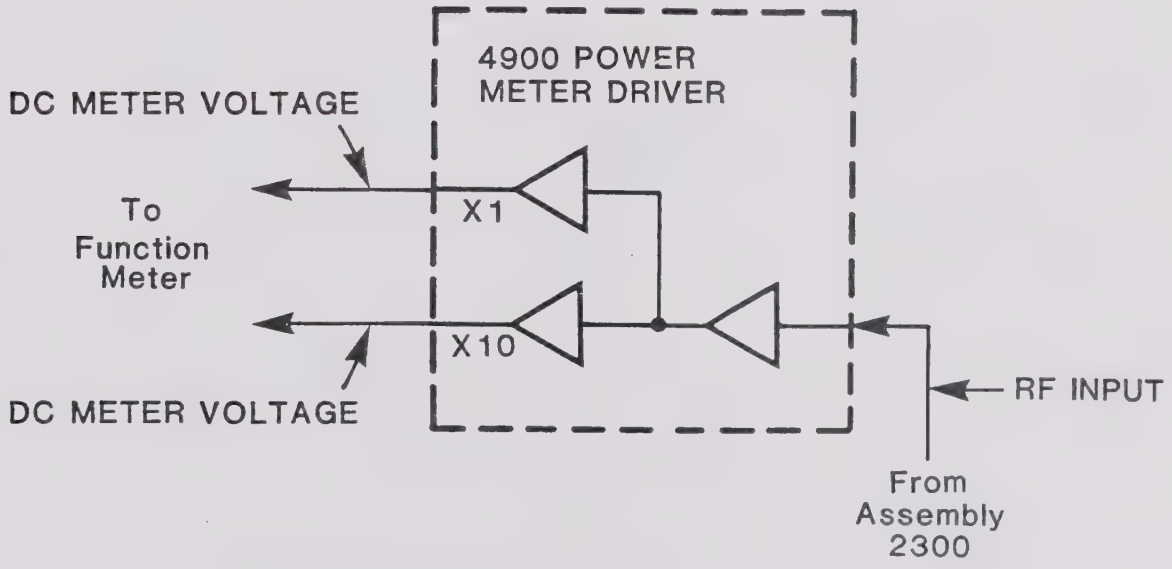


Figure 3-24. Power Meter Driver (4900).

Power Supply, Rear Panel (5100)

3.3.25 A block diagram of the 5100 Assembly is shown in Figure 3-25 below. The 5100 Assembly selects unregulated DC power, and converts 115/230V AC power to regulated 350V DC power. AC and DC input power connectors, fuses, and power switching controls are interconnected to transformer and rectifier components located on the inside of the rear panel.

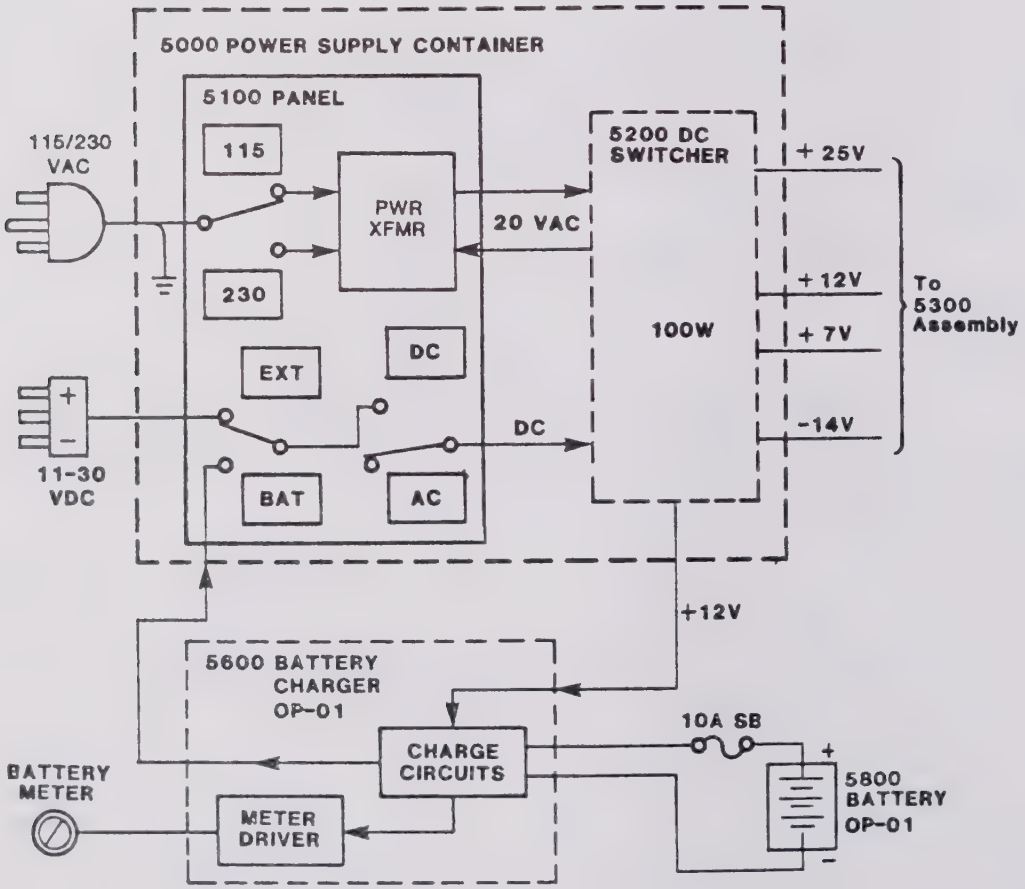


Figure 3-25. Power Supply Rear Panel (5100).

DC Switcher (5200)

3.3.26 A block diagram of the 5200 Assembly is shown in Figure 3-26 below. The 5200 Assembly converts an unregulated 350V DC input to regulated voltages of +25, +12, +7, and -14V DC. Overvoltage and undervoltage sensing circuitry, and overcurrent sensing circuitry protects the power supply components from damage due to high or low input voltage or excessive load current demand from other CE-4000 assemblies.

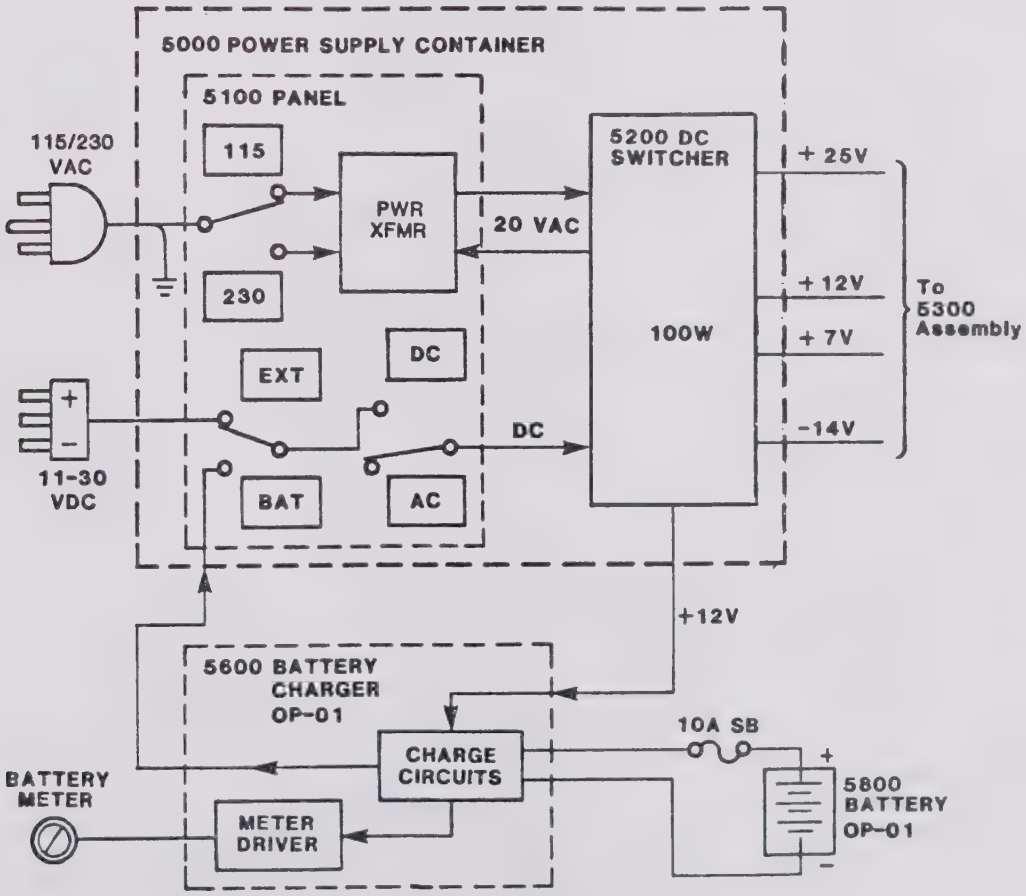


Figure 3-26. DC Switcher (5200).

Linear Regulator (5300)

3.3.27 A block diagram of the 5300 Assembly is shown in Figure 3-27 below. The 5300 Assembly provides unregulated 25V DC output to Assembly 3950 and Assembly 8300; regulated +10V DC, +5V DC, and -12V DC to the CE-4000 motherboard interface bus and other subassemblies, as required; audio amplification for the speaker; and overtemperature alarm circuitry.

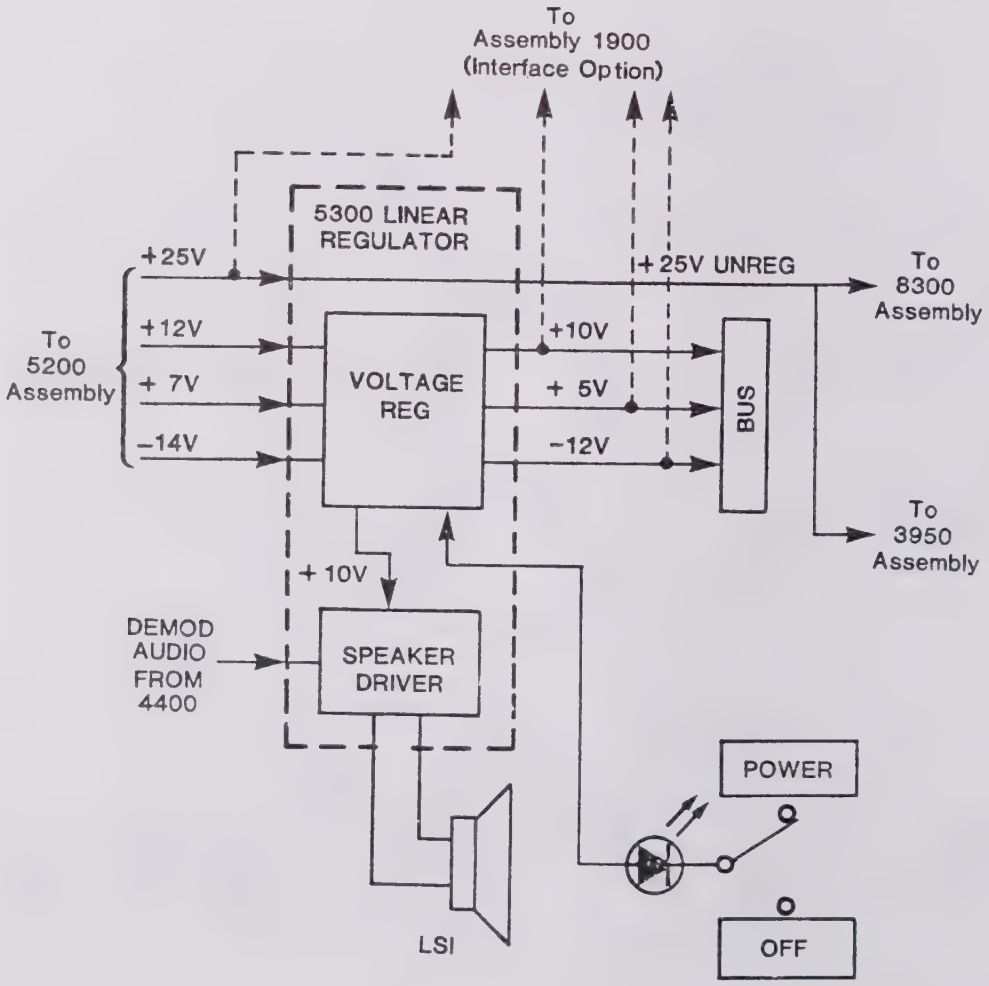


Figure 3-27. Linear Regulator (5300).

High Level Amplifier (7100)

3.3.28 A block diagram of the 7100 Assembly is shown in Figure 3-28 below. The 7100 Assembly is a switchable amplifier assembly used to boost the output of the CE-4000 for special applications where an uncalibrated output of over 10 mV is required. Amplifier control is through the front panel HIGH (UNCAL)/LOW switch, via the 4700 Relay Assembly. An amplification is achieved with only four RF amplifier ICs in series and 9 capacitors (five for coupling and four for power conditioning).

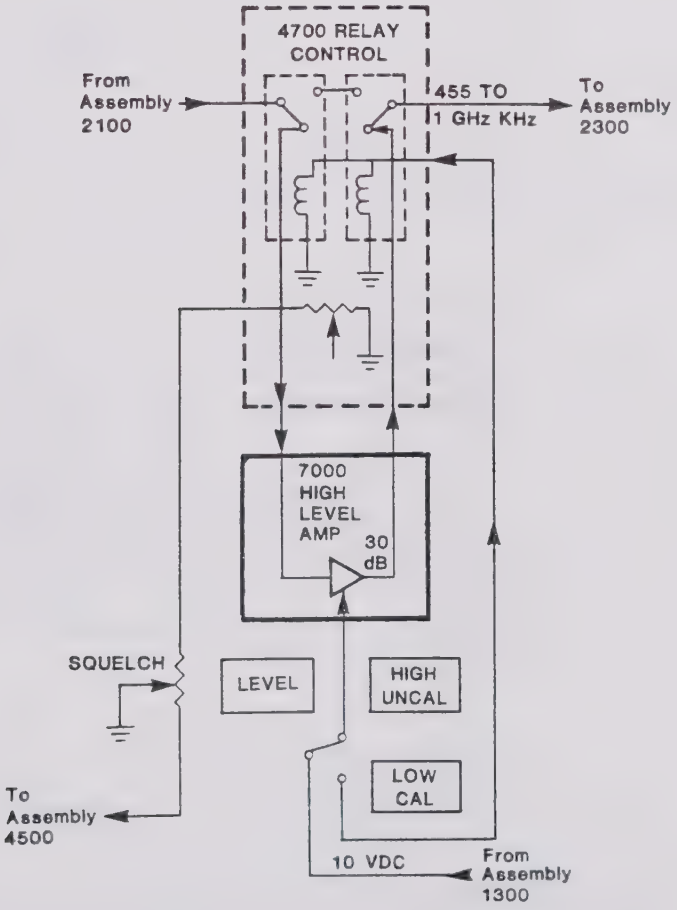


Figure 3-28. High Level Amplifier (7100).

High Voltage Power Supply (8300)

3.3.29 A block diagram of the 8300 Assembly is shown in Figure 3-29 below. The 8300 Assembly converts and multiplies a +25V DC input to +200V DC for CRT deflection circuitry; -1500V DC for CRT intensity and focus circuitry; -100V DC for CRT anode/grid supply; and 6.3V AC for CRT filament supply. The input to the DC/DC converter and voltage multiplier is current limited for overload protection.

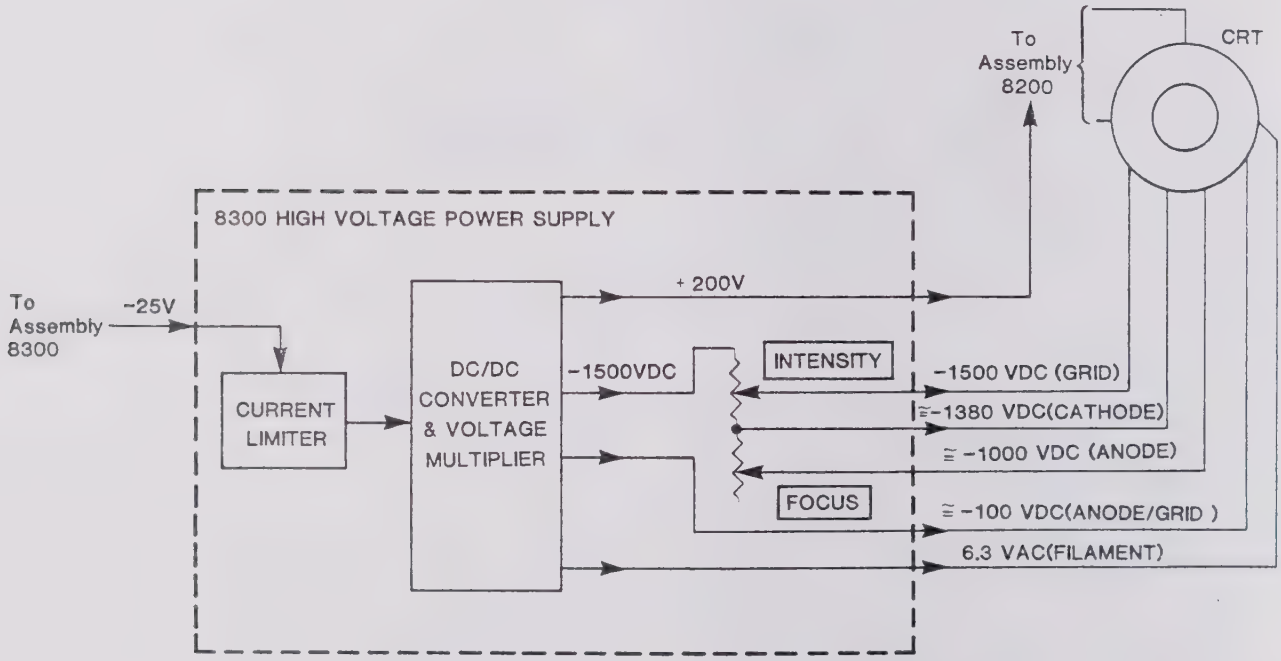


Figure 3-29. High Voltage Power Supply (8300).

SECTION 4
TROUBLESHOOTING AND REPAIR

INTRODUCTION

4.1 This section describes the procedures required for performance testing, troubleshooting, and making field-level repairs to the CE-4000. Adjustments required after making such repairs are also described. Extensive service and calibration procedures are beyond the scope of this manual. Such service should be performed only by trained service personnel at the Cushman factory, Regional Service Center, or other authorized facility.

SAFETY CONSIDERATIONS

4.2 The CE-4000 has been designed and manufactured in compliance with international safety standards. Observance of the cautions and warnings in this manual is important for the prevention of injury to personnel and damage to the instrument. Servicing or adjusting the instrument with the covers removed should be done only when necessary, and then only by a qualified technician who is aware of the hazards involved.

WARNING

Servicing the instrument with the protective covers removed and the AC power connected, is dangerous. Voltage present at various points in the instrument, if touched, can cause personal injury. Interruption or disconnection of the earth ground can make the instrument dangerous and is prohibited.

CAUTION

Make certain that all instruments and devices used with the CE-4000 are properly connected to earth ground before turning the instrument on.

CAUTION

Capacitors inside the instrument may remain charged for some time after the instrument has been disconnected from its power source.

FACTORY SERVICE

4.3 It is recommended that the instrument be returned to the factory or authorized service center for repair or annual calibration. This is due to the complexity of some of the CE-4000 circuits, and the special procedures necessary for their adjustment. In the event that calibration or repair is required, contact the Cushman Electronics Customer Service Department for information or to make arrangements for return of the equipment to the factory. The factory address is:

Cushman Electronics, Inc.
Customer Service Department
2450 North First Street
San Jose, California 95131
Telephone: (408) 263-8100

4.4 Cushman Electronics service is also available from regional service centers. The factory authorizes calibration, warranty and other service at these centers. To minimize turn-around time and shipping costs, use the nearest service center. Instructions for identification, packaging, and shipment of the instrument are described in Section 1 of this manual.

DESIGN AND TESTING

4.5 To ensure better reliability, Cushman printed circuit boards are temperature tested over a range of 0° to 55°C prior to installation. All CE-4000 Test Sets are then operated in heat chambers, and carefully inspected before shipment.

4.6 The exchangeable printed circuit boards illustrated in Figure 4-1 are readily accessible to expedite board swapping for troubleshooting and repair.

4.7 The printed circuit boards are designed to fit snugly for good electrical connection. A tool for use in circuit board removal is provided with each instrument; it should be used to prevent damage to circuit boards.

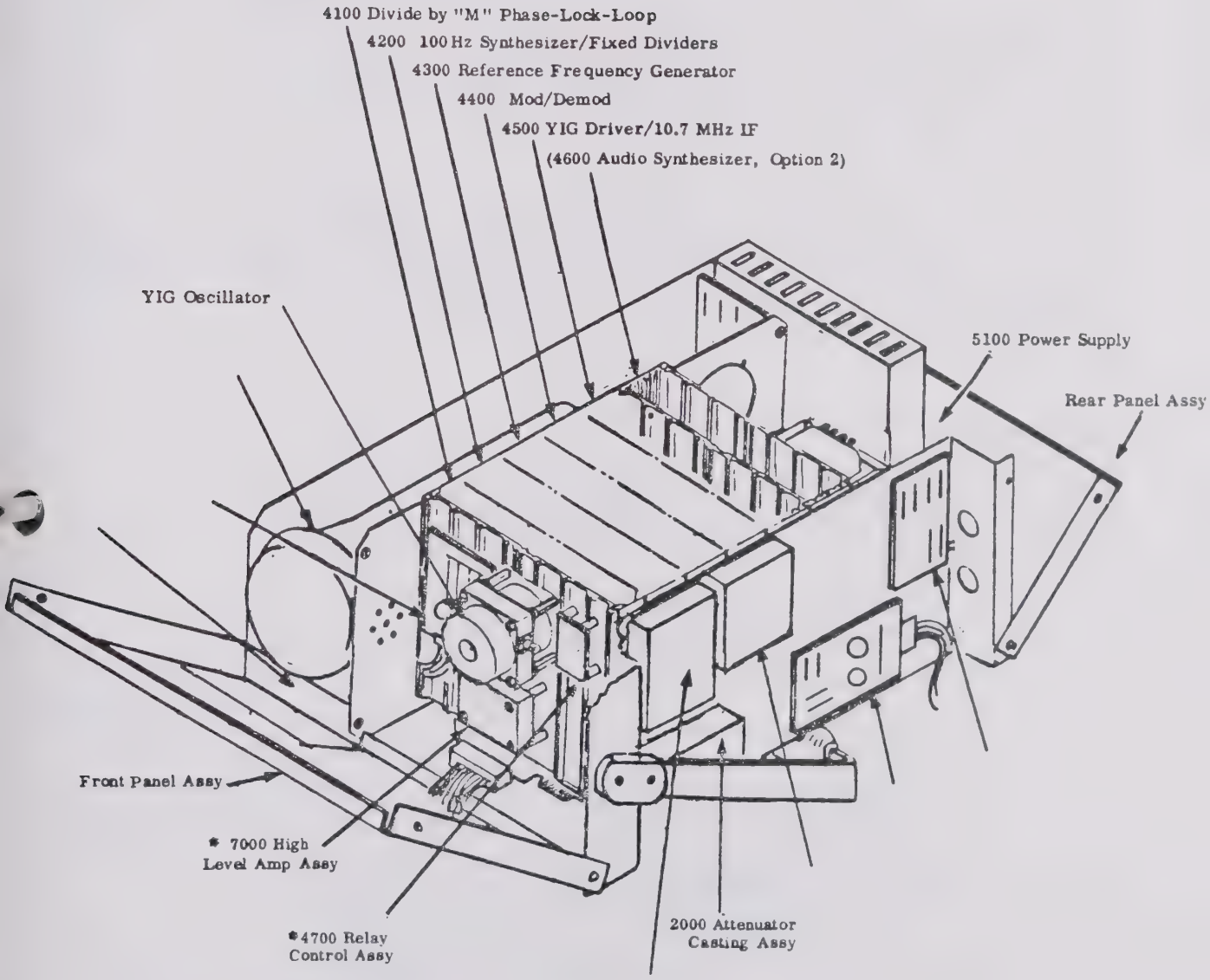


Figure 4-1. CE-4000 PCB and Component Location.

4.8 To facilitate access to test points and circuit connections, a circuit board extender (Cushman P/N 7001-0577) is available as an optional accessory.

BOARD EXCHANGE PROGRAM

4.9 Cushman Electronics offers a Printed Circuit Board Exchange Program, with telephone troubleshooting service and prompt air shipment to anywhere in the United States. For a nominal price, a fully tested and guaranteed exchange board can be obtained. Shipments will typically be made within 24 to 48 hours and, in many cases, replacement printed circuit boards can be delivered within 72 hours.

4.10 Attach a tag that summarizes the problem to the defective board, and return the board directly to the Cushman Factory. In order to receive credit for the defective board, it must be returned undamaged and unaltered. If the defective board is not received at the factory within 30 days after shipment of the replacment board, the full purchase price of the replacement board will be billed.

PERFORMANCE TESTS

4.11 The performance tests are used to determine if the CE-4000 is functioning properly. If unacceptable results are obtained, refer to the troubleshooting procedure given in this section. The performance tests are listed in Table 4-1.

Table 4-1. Performance Tests.

TEST TITLE	PARA NO.
Voltage Test	4.11.3
Receive Mode	4.11.4
SINAD Meter Check	4.11.5
Receiver Sensitivity Check	4.11.6
Generate Mode Checks	4.11.7
Output Level Check	4.11.8
Power Meter Driver Check	4.11.9

Equipment Required

4.11.1 The following equipment, or its equivalent, is required for the performance tests.

FM RF Signal Generator, Cushman CE-50A Communications Monitor

150W/15W Power Meter, HP436A

Audio Frequency Generator, Cushman CE-50A Communications Monitor

Oscilloscope, Cushman CE-50A Communications Monitor

4.11.2 Perform the following mechanical and visual inspection of the instrument before beginning electrical testing:

a) Shipping damage.

b) Fasteners loosened during shipment.

c) Rear panel 115/230V switch in proper position.

d) For units with Option 01 installed, check that the BATTERY/EXT DC switch is in the BATTERY position.

e) Adjust the mechanical zero adjustment screws for a zero meter indication if the front panel meters do not indicate zero.

Voltage Test

4.11.3 This test is used to verify the presence of +5V, +10V, +12V,-12V, and +25V internal operating voltages necessary for proper functioning of CE-4000 circuitry. Perform the test as follows:

a) Attach the power cable to the rear panel receptacle and insert the male connector into the 115 volt power source.

b) Place the POWER/OFF switch in the POWER position.

c) Verify that the UNLOCK LED light is on, indicating the presence of +5V, +10V, and +12V DC.

d) Set the CE-4000 RECEIVE/GENERATE switch to the GENERATE position, and rotate the FREQ OFFSET control clockwise and counterclockwise, observing the FREQUENCY ERROR Meter. Meter pointer movement indicates the presence of +10V and -12V DC.

e) Turn the oscilloscope INTENSITY/OFF switch to midrange and allow 2 minutes for CRT warm-up. Rotate the INTENSITY control clockwise until a trace appears on the CRT. The presence of a trace indicates that the +25V DC is present.

Receive Mode

4.11.4 The receive mode test procedure checks the operational capability of the CE-4000 in the RECEIVE mode. Perform the tests as follows:

a) Connect the CE-4000 ANT INPUT to the RF Signal Generator.

b) Connect the CE-4000 DEMOD OUT jack to the oscilloscope.

c) Connect the CE-4000 MOD IN jack to the Audio Generator.

d) Set the SELECTIVITY switch on each instrument to WIDE.

e) Set the CE-4000 SQUELCH to MIN (maximum sensitivity).

f) Set the CE-4000 LEVEL HIGH (UNCAL)/LOW (UNCAL) switch to LOW (UNCAL).

g) Set the CE-4000 RECEIVE/GENERATE switch to the RECEIVE position.

h) Set the RF Signal Generator to -50dBm and 26 MHz.

i) Set the FREQUENCY (MHz) switches to 026.0000 MHz.

j) Set the FREQUENCY ERROR RANGE switch to 1.5 kHz/DEV.

k) Turn the CE-4000 and the Signal Generator tone generators off.

l) Rotate the Frequency Offset control on the CE-4000 clockwise or counterclockwise for full scale meter deflection.

m) Set the FREQUENCY (MHz) switches on the CE-4000, and the RF Signal Generator to 915.0000 MHz.

n) Set the FREQUENCY ERROR RANGE switch to 15 kHz.

o) Offset the frequency control using Vernier control on the RF Signal Generator. The FREQUENCY ERROR Meter on the CE-4000 should now deflect according to the amount of frequency offset.

p) Set the CE-4000 Function Meter switch to 15 kHz/DEV.

q) Set the CE-4000 Oscilloscope VERT/DIV switch to 6 kHz.

r) Zero the CE-4000 FREQUENCY ERROR Meter with FM CAL (Offset) control.

s) Connect a cable between the Audio Frequency Generator output and the CE-4000 MOD IN connector.

t) Set the Audio Frequency Generator to 1000 Hz and adjust the output level for a FREQUENCY ERROR Meter deflection of 5 kHz.

u) Verify an oscilloscope display of 1 kHz at a 750 millivolt peak to peak amplitude.

SINAD Meter Check

4.11.5 The SINAD test checks the signal, noise, and distortion characteristics for a radio signal. Mathematically stated, SINAD characteristics = (signal + noise + distortion) ÷ (noise + distortion). Perform the check as follows:

a) Connect the RF Generator output to the CE-4000 SINAD IN connector.

b) Modulate the RF Signal Generator with 2111 Hz and the RF output at 0dB.

c) Set the CE-4000 Function Meter switch to the 15 kHz position.

d) Set the CE-4000 RECEIVE/GENERATE switch to GENERATE.

e) Adjust the CE-4000 MOD IN controls for 5 kHz deviation on the CE-4000 Function Meter.

f) Set the CE-4000 Function Meter switch to SINAD.

g) Verify that the CE-4000 Function Meter SINAD scale reads 0dB.

h) Disconnect the coaxial cable from the RF Generator.

i) Reset the CE-4000 Function Meter switch to the 15 kHz position.

j) Turn on the CE-4000 MOD ADJ (1 kHz)/OFF control and adjust for 15 kHz deviation on the Function Meter.

k) Reset the CE-4000 Function Meter switch to SINAD.

l) Verify that the SINAD scale of the CE-4000 Function Meter reads 30dB SINAD.

m) Re-connect the coaxial cable to the RF Generator.

n) Verify that the CE-4000 Function Meter SINAD scale now reads 10dB $\pm$1.5dB.

Receiver Sensitivity Check

4.11.6 The Receiver Sensitivity check tests the ability of the CE-4000 receiver circuitry to respond to a specified level of signal. Perform the check as follows:

a) Set the CE-4000 RECEIVE/GENERATE switch to the RECEIVE position.

b) Remove modulation from the RF Generator output.

c) Turn the CE-4000 SQUELCH control to MIN (max sensitivity).

d) Set the CE-4000 SELECTIVITY switch to NARROW.

e) Set the RF Signal Generator output signal level to -60dBm with 1 kHz tone modulated to 5 kHz deviation.

f) Verify that the CE-4000 Function Meter SINAD scale reads >10dB SINAD.

g) Reset the RF Signal Generator output to -102dBm.

h) Verify that the CE-4000 SINAD Meter reads >10dB SINAD.

Generate Mode Checks

4.11.7 The following checks verify Signal Generator output frequencies, levels, and deviation. Perform the checks as follows:

a) Connect the CE-4000 SIG GEN OUT/RF IN to the RF Signal Generator output.

b) Connect the CE-4000 MOD OUT to the CE-4000 MOD IN.

c) Connect the CE-4000 VERT IN to the CE-5110 DEMOD OUT.

d) Switch the CE-4000 to GENERATE with the SIG GEN LEVEL control to 100 microvolt (vernier in X1 position).

e) Set the CE-4000 FREQUENCY (MHz) switch to 026.0000 MHz.

f) Set the FREQUENCY ERROR RANGE switch to 1.5 kHz/DEV.

g) Move the Frequency Offset control on the CE-4000. The FREQUENCY ERROR Meter should deflect an amount equal to the Frequency Offset.

h) Change the FREQUENCY MHz switches to 915.0000 MHz.

i) Set the FREQUENCY ERROR Range switches to 15 kHz.

j) Move the Frequency Offset control on the CE-4000. The FREQUENCY ERROR Meter should deflect.

k) Add a 1 kHz tone modulated to 5 kHz deviation from the SIG GEN OUT/RF IN into the CE-4000. The Deviation Meter on the CE-4000 should read 5 kHz ±15% of full scale. The oscilloscope on the CE-4000 should read 750 millivolts ±75 millivolts peak to peak.

Output Level Check

4.11.8 The Output Level Check tests to determine the ability of the CE-4000 to provide output power at all frequencies within the limits of CE-4000 specifications. Perform the check as follows:

a) Set the Oscilloscope HORIZ/DIV control to 10 milliseconds.

b) Set the Oscilloscope VERT/DIV control to 50 mV.

c) Set the CE-4000 to GENERATE with the level switch in the LOW (CAL) position.

d) Set the CE-4000 Frequency (MHz) switches on the front panel to 950 MHz.

e) Set the CE-4000 SIG GEN LEVEL control on the front panel to 10 mV (1 mV with vernier at X10).

f) Set the CE-4000 modulation adjust controls to OFF, or the minimum position.

g) Increment the 10 MHz and 100 MHz digits of the frequency entry switches on the CE-4000 and the RF Signal Generator in 10 MHz steps. The CE-4000 Oscilloscope display should be -27dBm $\pm$4dBm at all steps.

Power Meter Driver Check

4.11.9 The Power Meter Driver Check tests the proper functioning of the Power Detector, Power Protector Relay circuitry, and the Function Meter Circuitry. Perform the check as follows:

NOTE

If the CE-4000 LEVEL switch has been set to HIGH before this test is begun the HIGH LEVEL LED is a useful indicator of when the relay switches.

a) Set the CE-4000 FREQUENCY (MHz) select switches to 150 MHz.

b) Attach the output of the RF Signal Generator and Power Meter to the SIG GEN OUT/RF IN jack on the CE-4000.

c) Set the CE-4000 Function Meter switch to the 15W power position.

d) Adjust the RF Signal Generator output to 15 watts; the CE-4000 Power Meter should also read 15 watts.

e) Set the CE-4000 Function Meter switch to the 150 watt power range.

f) Disconnect the coaxial cable from the RF Signal Generator.

g) Set the power amplifier output to 1 watt, the CE-4000 should read 0 on the 150W Meter scale.

h) Reconnect the RF Signal Generator and set the output to 0dBm

i) Increase the input to the CE-4000 to 150 watts. The CE-4000 Power Meter should also read 150 watts.

j) While monitoring the meter tracking, adjust the RF Signal Generator output to the levels and frequencies most utilized.

k) Turn the RF Signal Generator off.

l) Switch the CE-4000 to GENERATE mode.

m) Turn the RF power from the RF Signal Generator on and slowly increase the RF power. The CE-4000 Power Meter relay should switch before 0.5W of output is exceeded.

TROUBLESHOOTING

4.12 Troubleshooting procedures for the CE-4000 are presented in a series of flow diagrams. Figures 4-2 through 4-15 show a logical process of troubleshooting for problems that may be encountered during normal use.

4.13 Although the flow diagrams cannot cover all of the problems or all of the solutions, they do serve as useful guides in localizing a fault and determining which printed circuit board is the cause. If properly followed, the flow diagrams provide a logical process of elimination, leading to a failed board. When the failed board is located, it can be exchanged readily, as explained in paragraph 4.9.

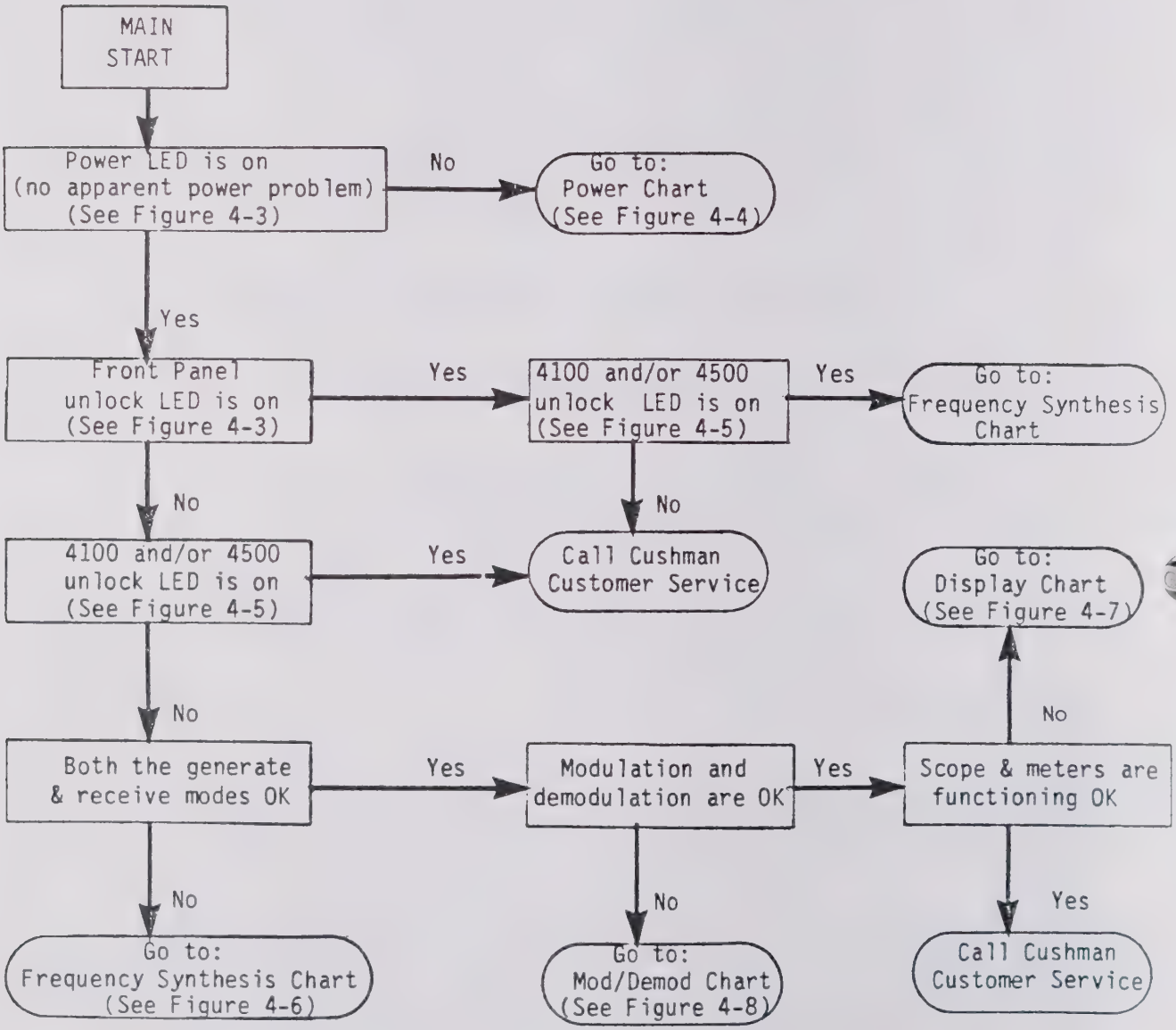
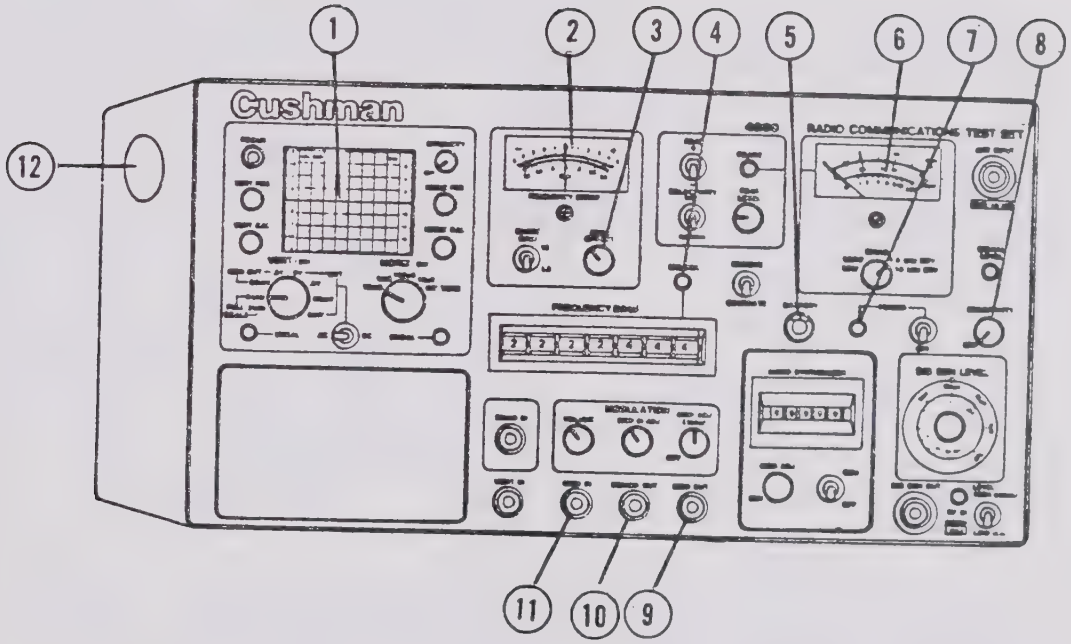


Figure 4-2. Main Start Flow Diagram



1. Oscilloscope
2. Frequency Error Meter
3. Frequency Offset
4. UNLOCK LED
5. Battery
6. Function Meter
7. POWER LED
8. SQUELCH
9. MOD OUT
10. DEMOD OUT
11. MOD IN
12. Speaker

Figure 4-3. CE-4000 Front Panel.

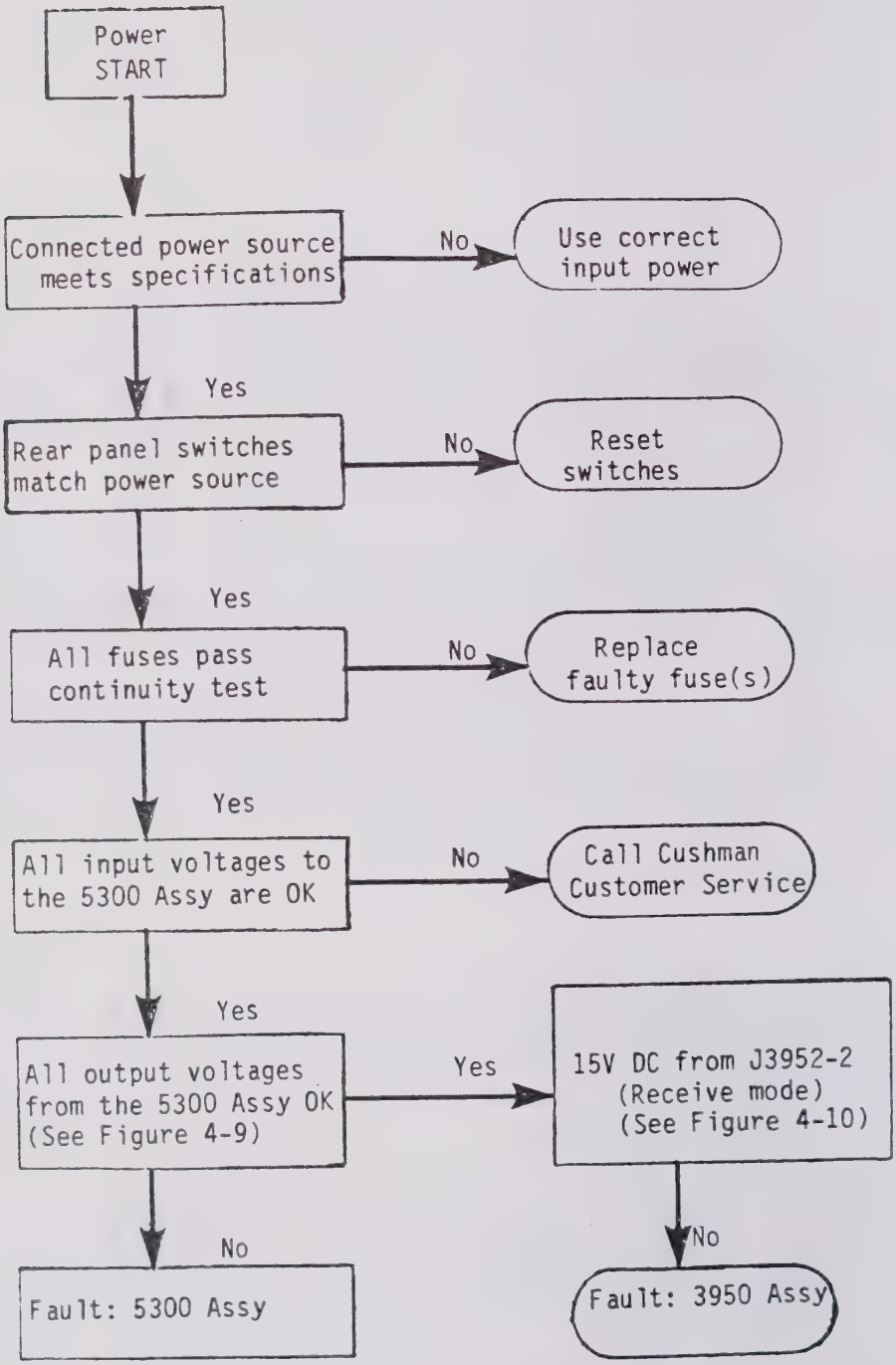


Figure 4-4. Power Flow Diagram.

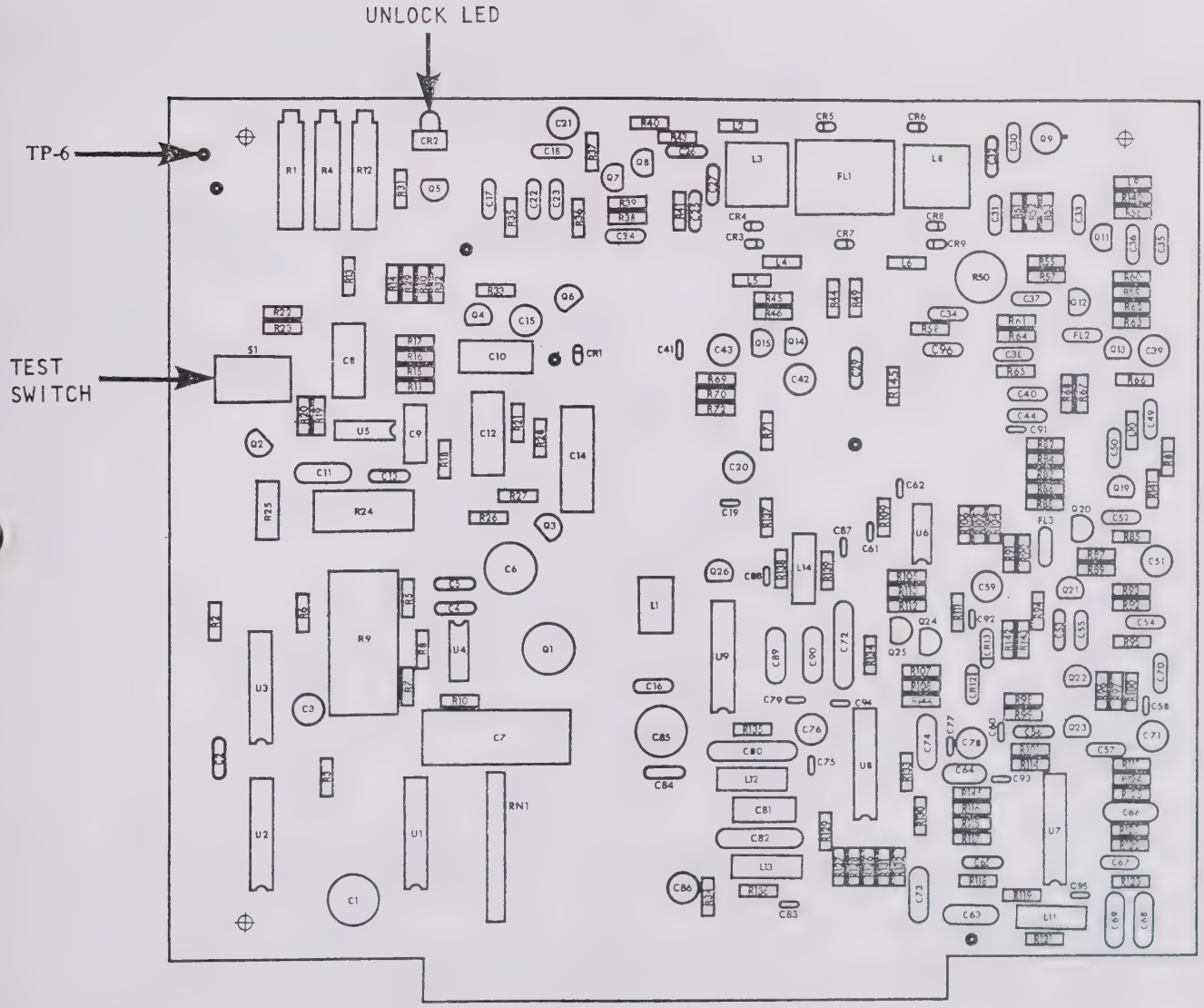


Figure 4-5. 4500 YIG Driver/10.7 MHz I.F.

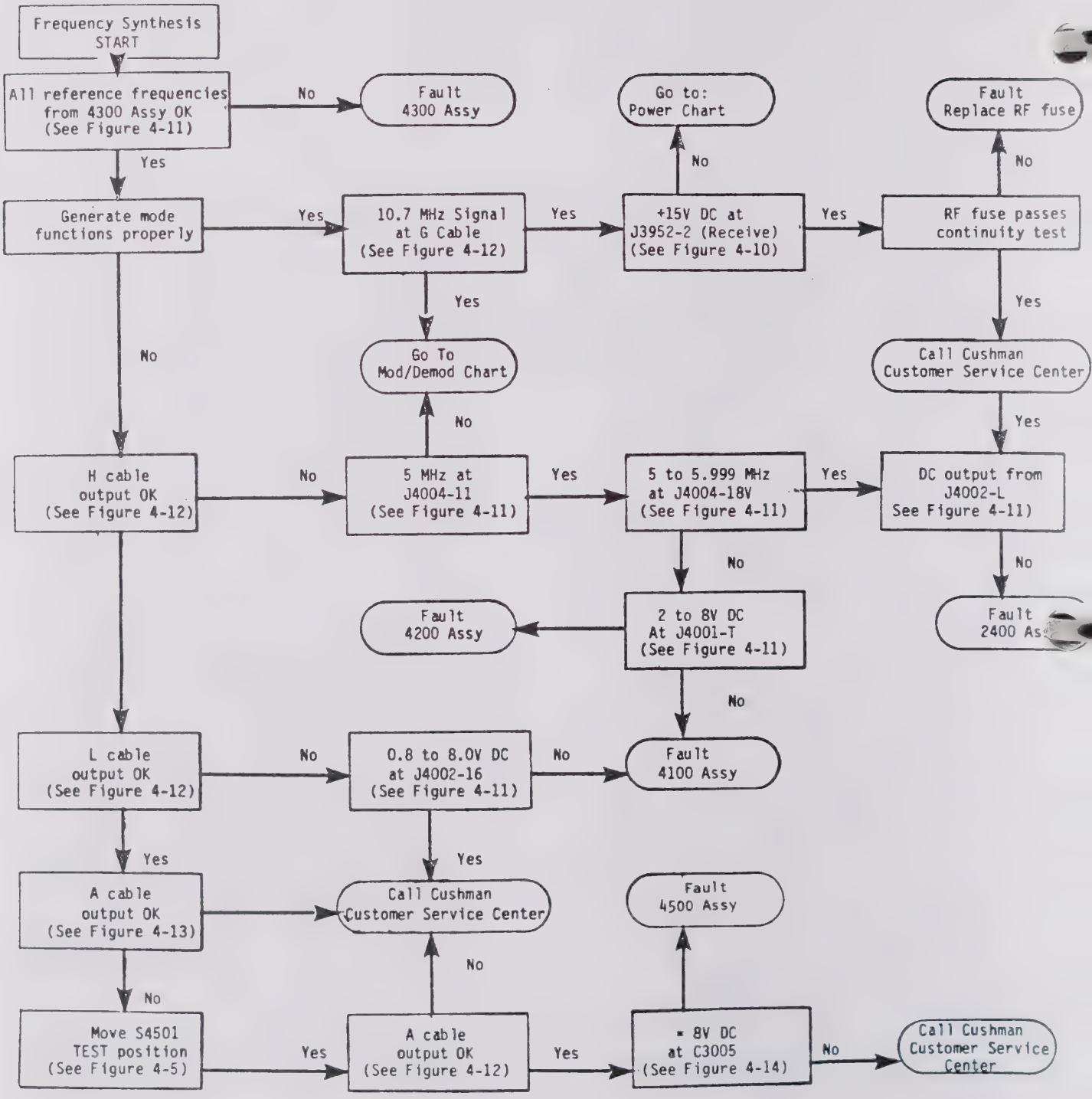


Figure 4-6. Frequency Synthesis Flow Diagram.

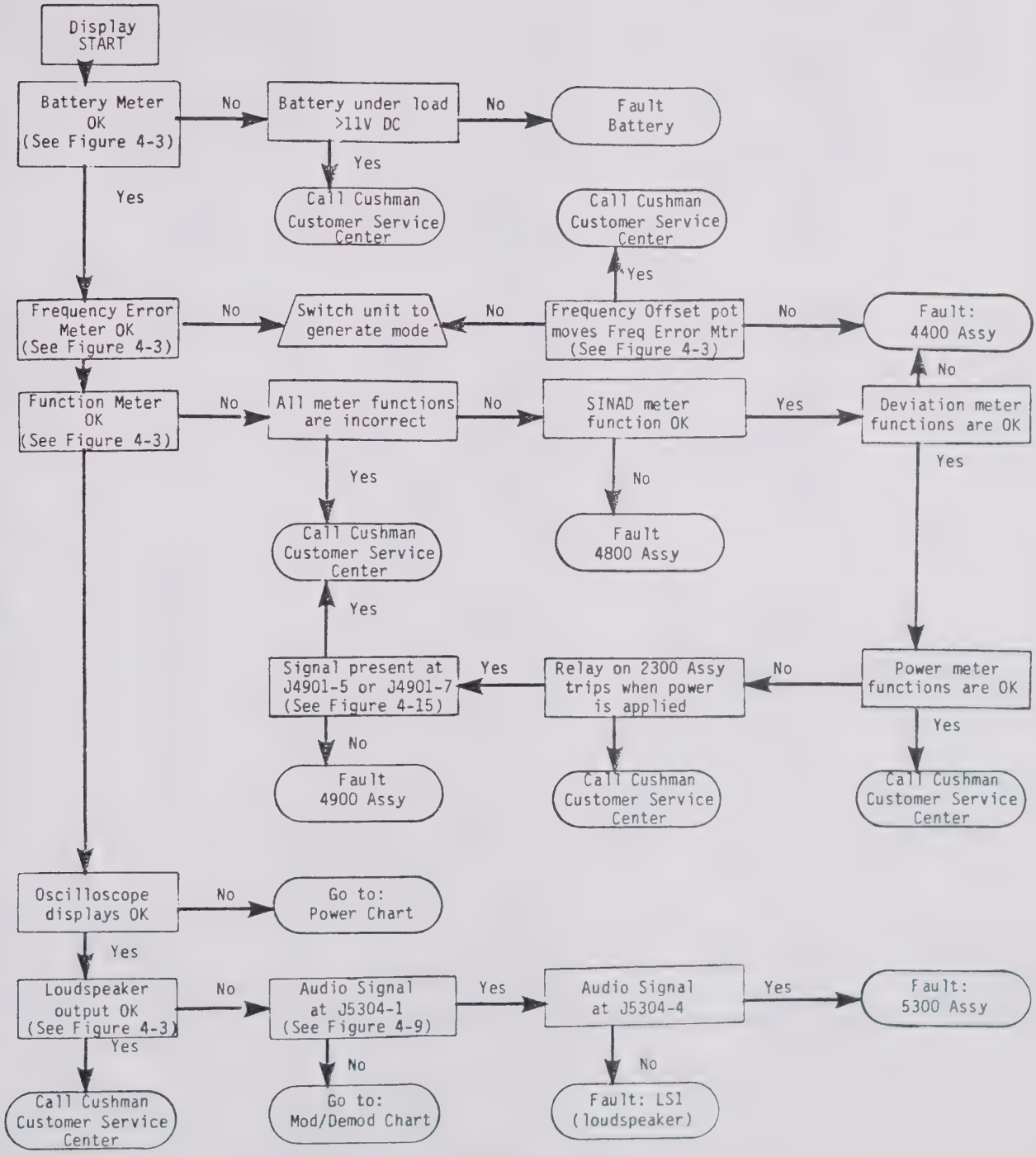


Figure 4-7. Display Flow Diargram

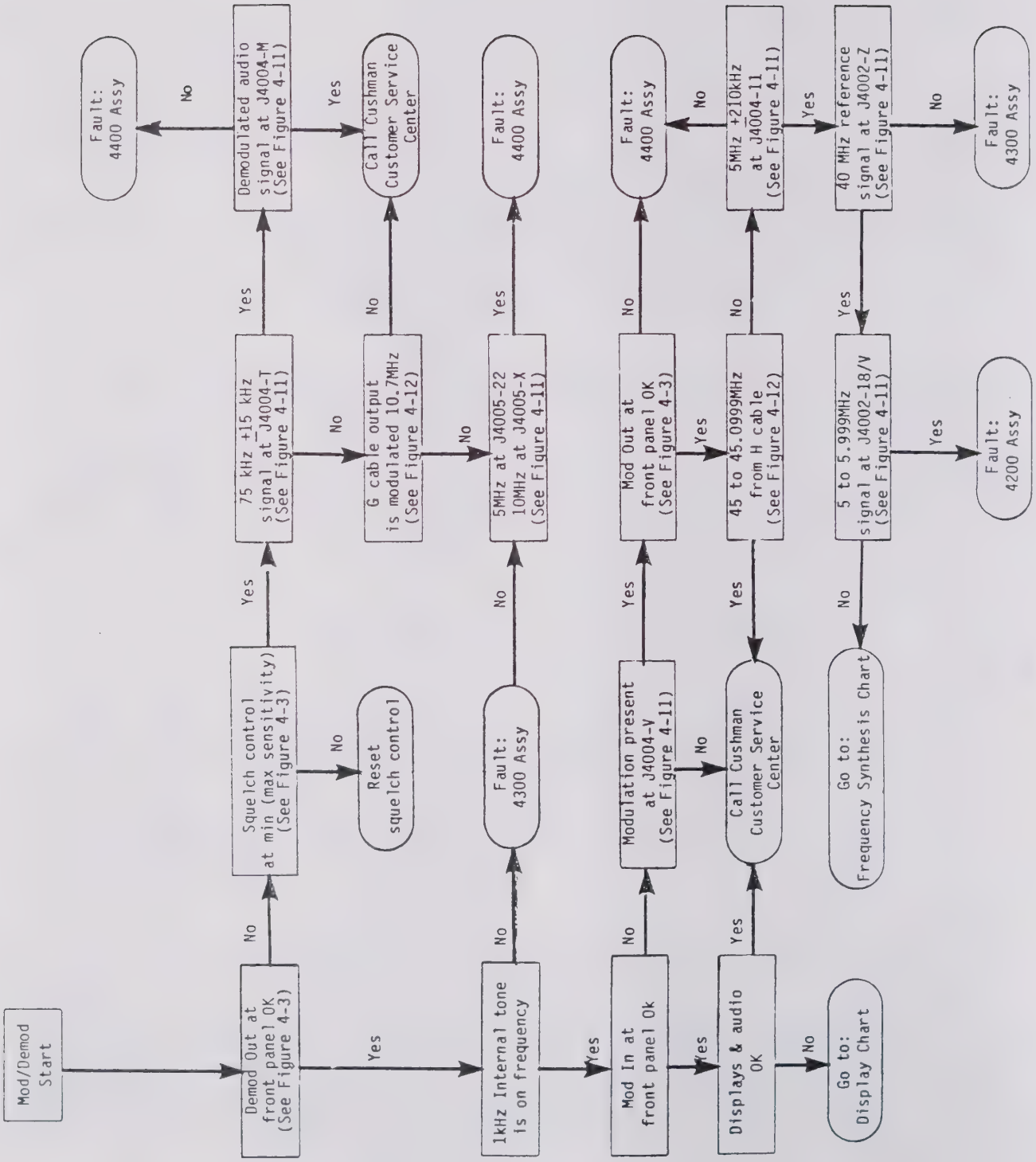


Figure 4-8. Mod/Demod Flow Diagram

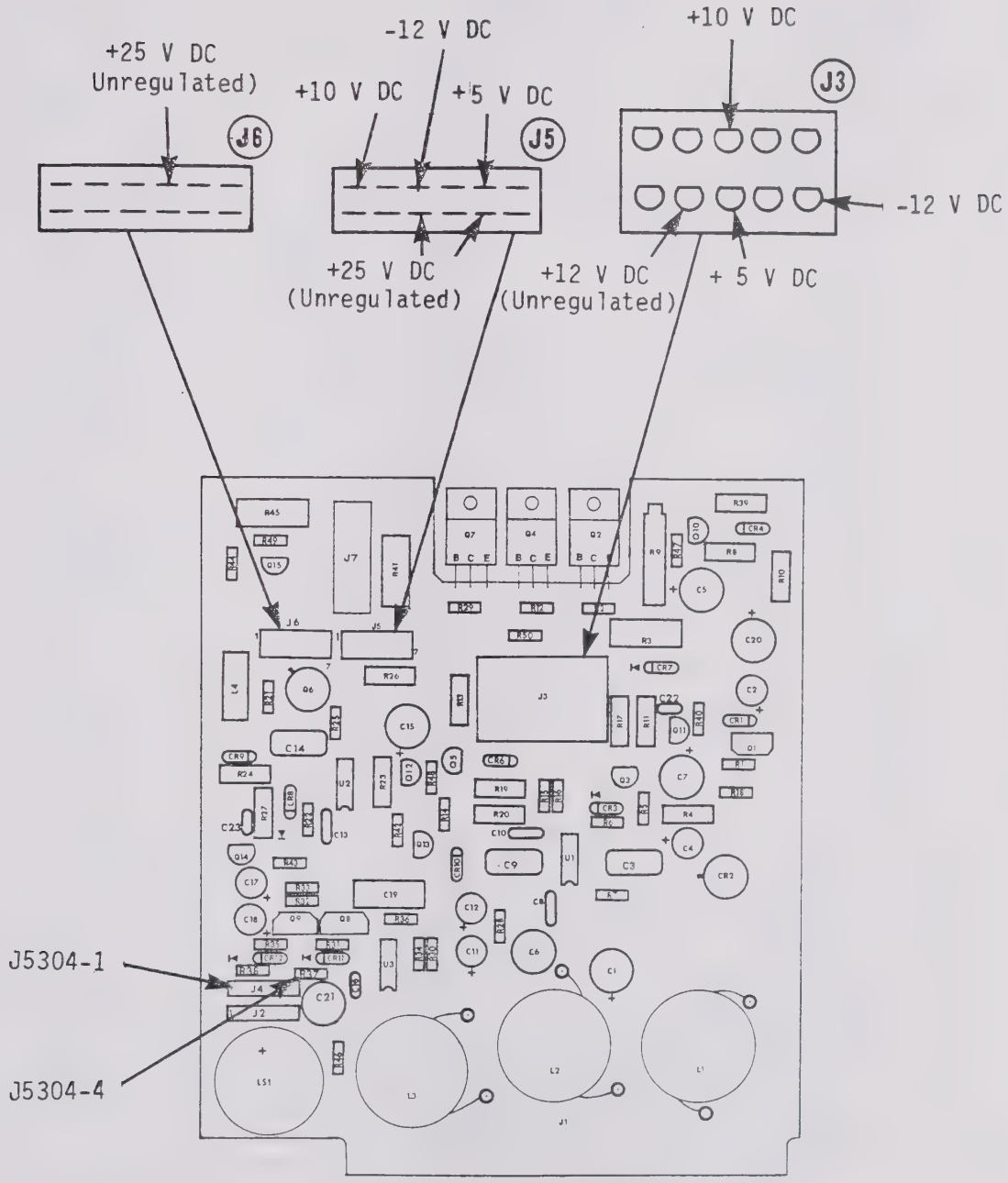


Figure 4-9. 5300 Linear Regulator.

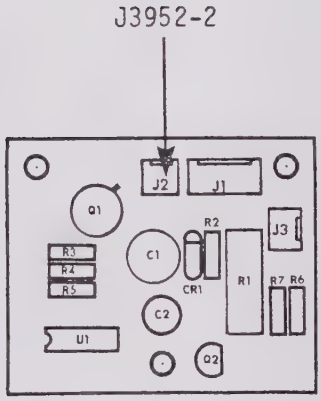


Figure 4-10. 3950 Receiver Converter

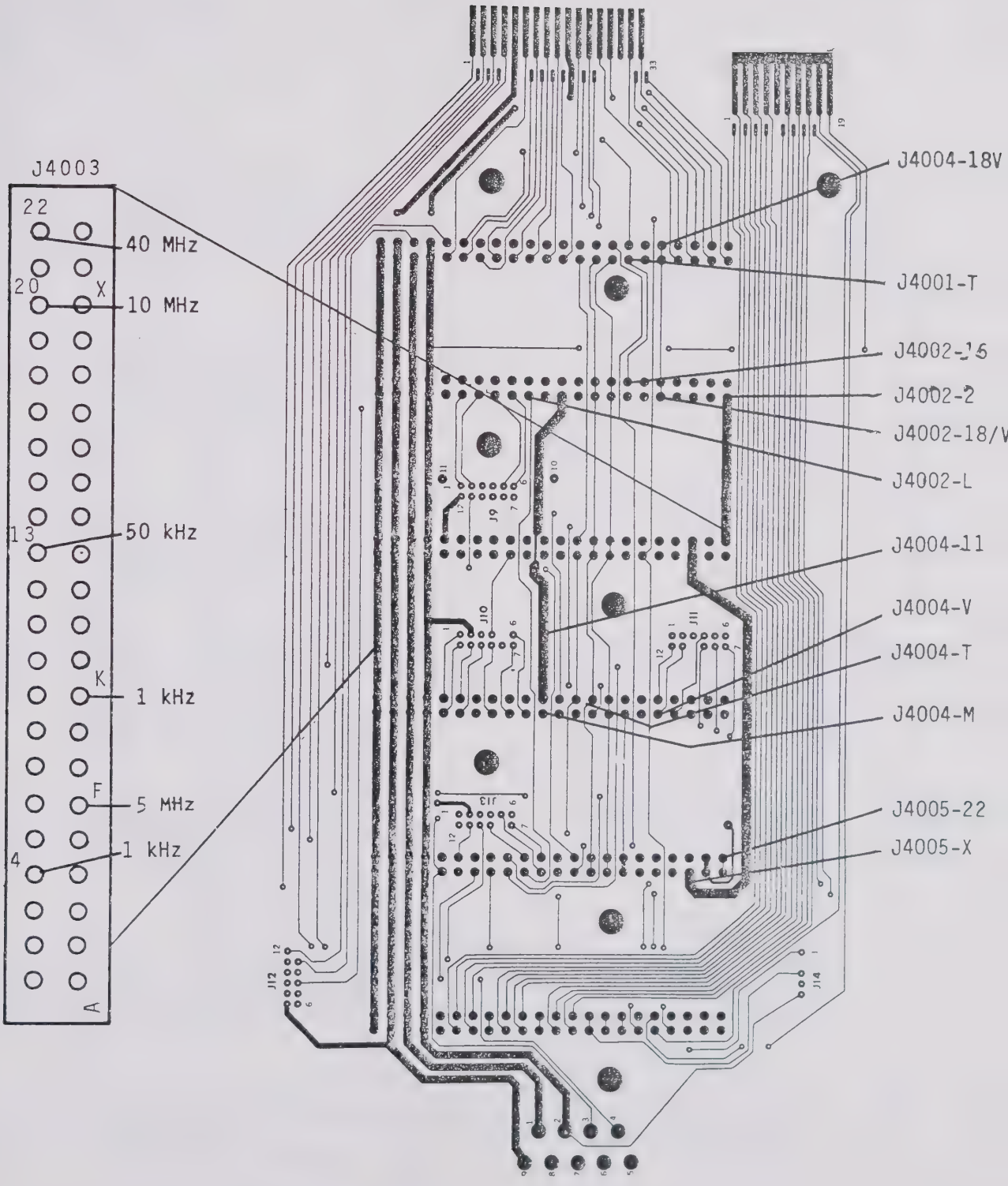


Figure 4-11. 4000 Motherboard Interconnect.

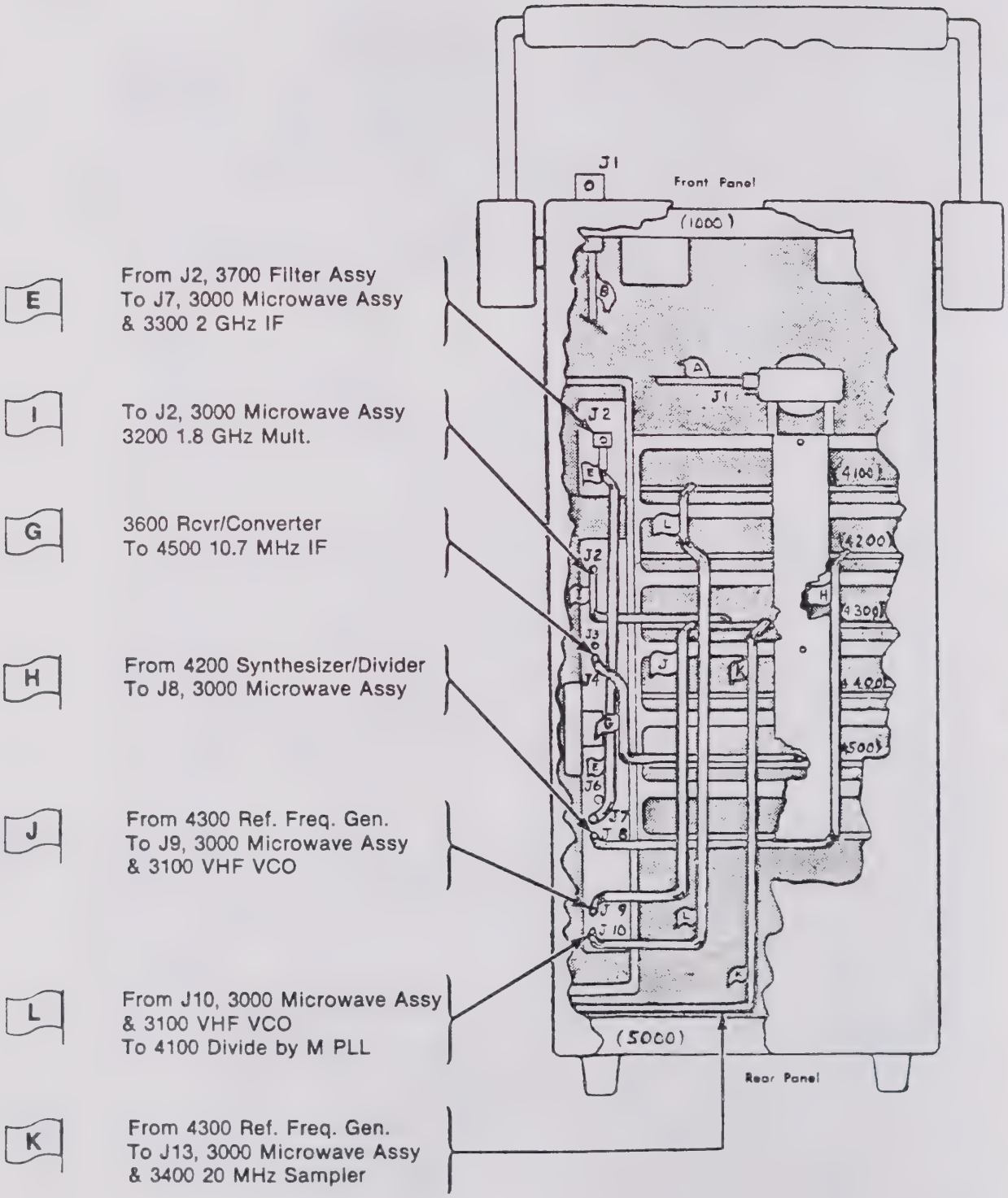


Figure 4-12. CE-4000 Interconnect Cables Top View.

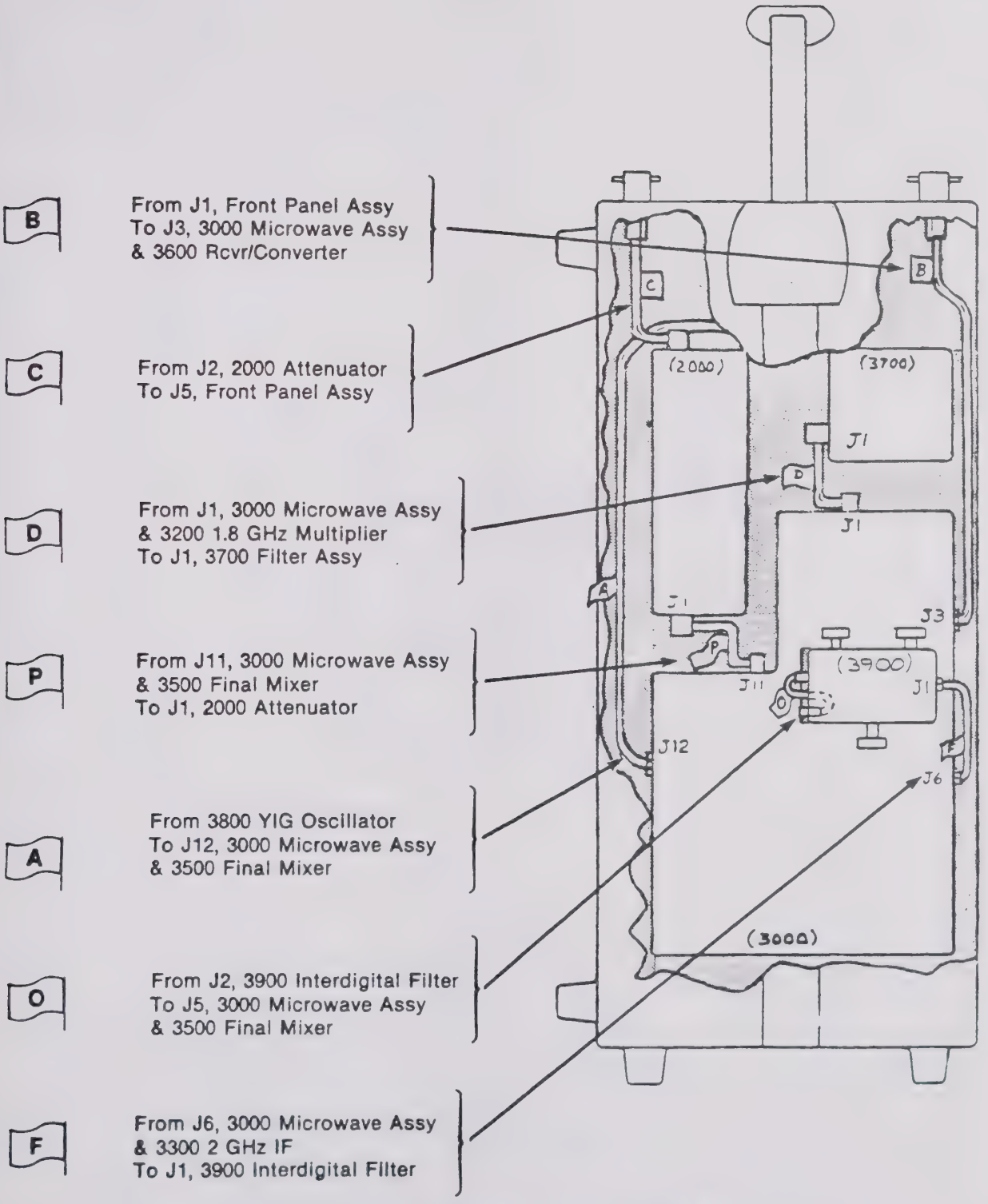


Figure 4-13. CE-4000 Interconnect Cables Side View.

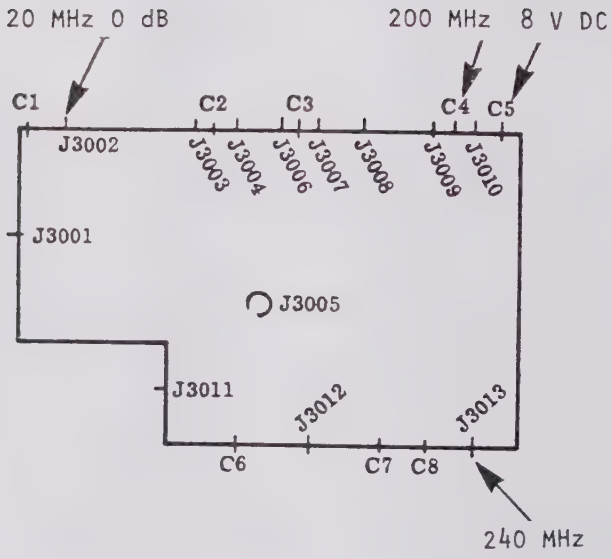


Figure 4-14. 3000 Microwave Casting Interconnect.

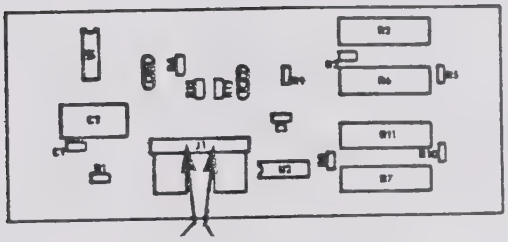


Figure 4-15. 4900 Power Meter Driver Assembly.

ADJUSTMENT PROCEDURES

4.14 The following paragraphs describe the adjustment procedures which may be required after making field level repairs. The adjustment procedures are listed in Table 4-2. If attempts to restore the CE-4000 to its proper operating condition fail, re-calibration or overhaul may be required. Such procedures are beyond the scope of this manual. It is recommended that they be performed by the factory or an authorized service center.

Table 4-2. Adjustment Procedure.

TITLE	PARA. NO.
YIG Reference Voltage Adjustment	4.15
Mod/Demod Board Adjustments	4.16
Frequency Errot Meter Adjustments (Receive Mode)	4.16.1
Frequency Error Meter Adjustments (General Mode)	4.16.2
Deviation Meter Adjustment	4.16.5
Modulation Out	4.16.7
Power Meter Driver Adjustment	4.17
SINAD Meter Adjustment	4.18
Frequency Accuracy Adjustment	4.19

CAUTION

Make only the adjustments described in this section. Any other adjustments will require recalibration of the instrument.

Yig Reference Voltage Adjustment

4.15 The YIG reference voltage adjustment may be necessary upon repair or replacement of the 4500 YIG Driver/10.7 MHz IF board. Before making an adjustment, check for the presence of +10.000 ±0.001V DC at test point 6 on the 4500 Assembly (See Figure 4-16). If an adjustment of the voltage at test point 6 is required, adjust potentiometer R9 on the 5300 Linear Regulator Assembly (See Figure 4-17).

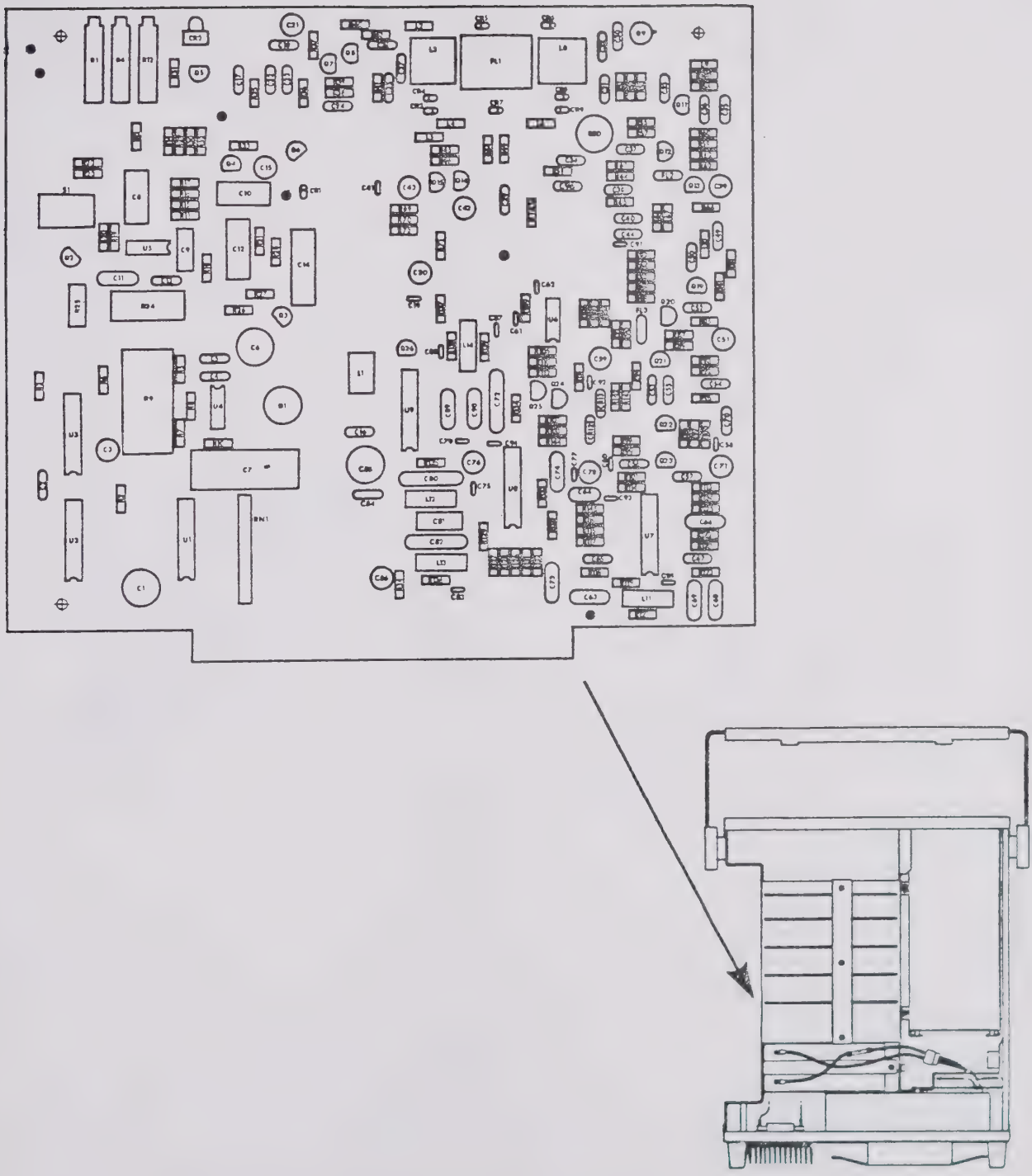


Figure 4-16. +10V YIG Reference Voltage.

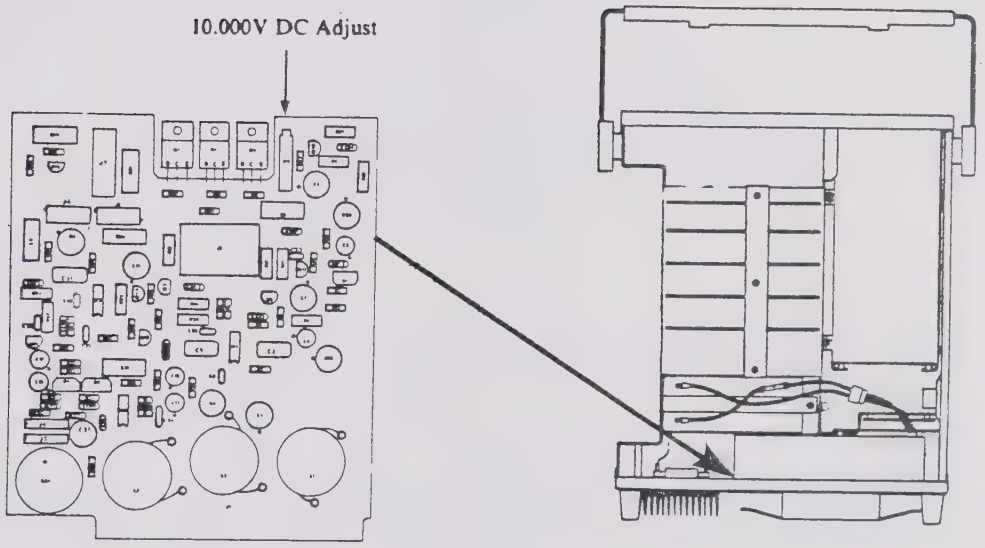


Figure 4-17. Reference Voltage Adjust.

WARNING

The 5100 Power Supply Container Assembly contains no user serviceable component. To avoid the possibility of electrical shock, access is restricted to authorized service personnel only.

Mod/Demod Board Adjustments

4.16 The following adjustments (paragrahs 4.16.1 through 4.16.8) may be necessary upon repair or replacement of the 4400 Mod/Demod board.

Frequency Error Meter Adjustment (Receive Mode)

4.16.1 Set the CE-4000 controls as follows:

a) RECEIVE/GENERATE switch to RECEIVE.
b) FREQUENCY ERROR Meter RANGE switch to 1.5.
c) FREQUENCY (MHz) switches to 000.0000.
d) SQUELCH to maximum (fully CW for minimum sensitivity).

4.16.2 Adjust as follows:

a) To electrically zero the FREQUENCY ERROR Meter, adjust potentiometer R23 on the 4400 MOD/DEMOD board (See Figure 4-18).

b) To balance the discriminator, adjust R1 on the 4700 Relay Control Assembly (See Figure 4-19) until the SIGNAL LEVEL indicator on the front panel just turns off. Then, readjust R1 until the indicator just turns on.

Frequency Error Meter Adjustment (Generate Mode)

4.16.3 Set the CE-4000 controls as follows:

a) RECEIVE/GENERATE switch to GENERATE.
b) FREQUENCY ERROR Meter RANGE switch to 1.5.
c) FREQUENCY (MHz) switches to 025.0000.

4.16.4 Adjust as follows:

a) Adjust 25.0000 MHz output at the SIG GEN OUT jack (zero offset).

b) On the 4400 MOD/DEMOD Assembly (See Figure 4-18), adjust R128 to electrically zero the FREQUENCY ERROR Meter.

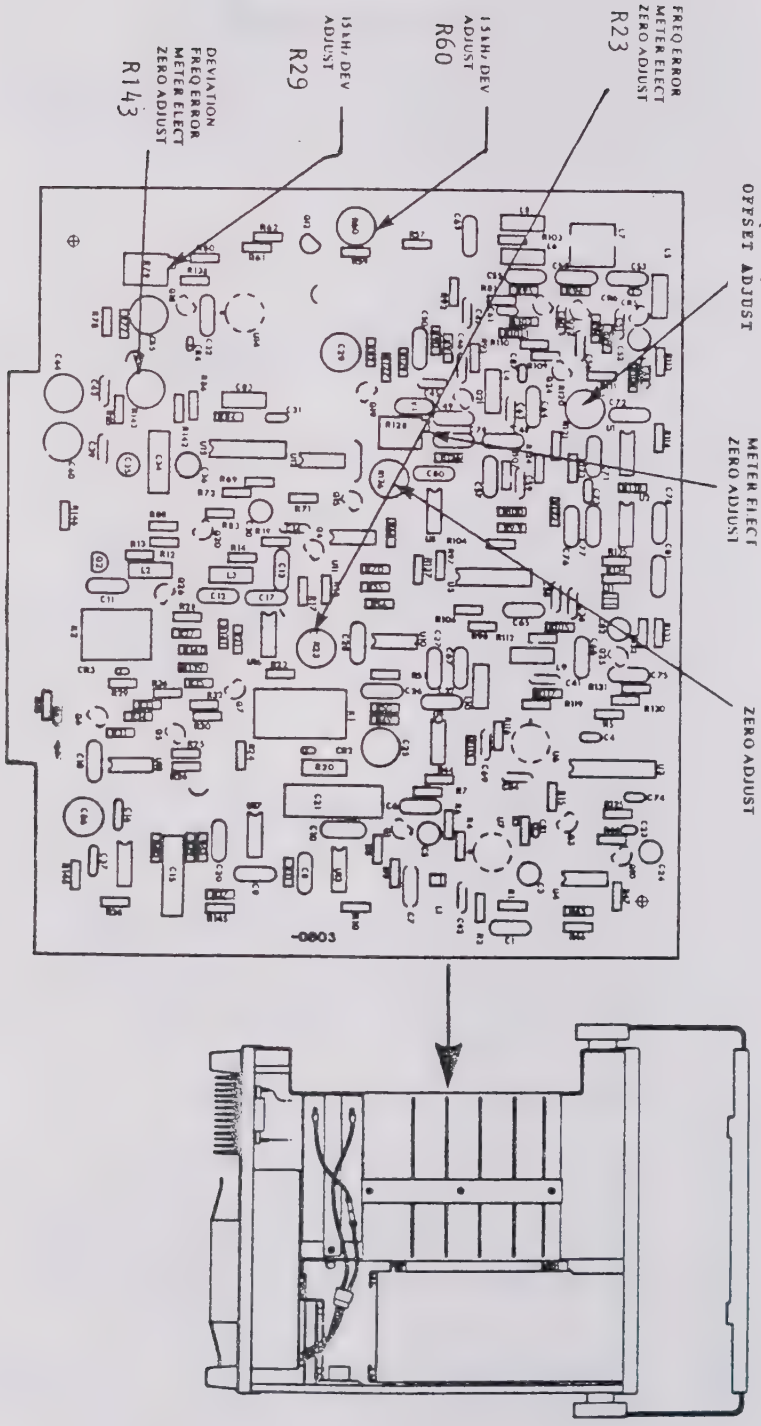


Figure 4-18. 4400 MOD/DEMOD Adjustments.

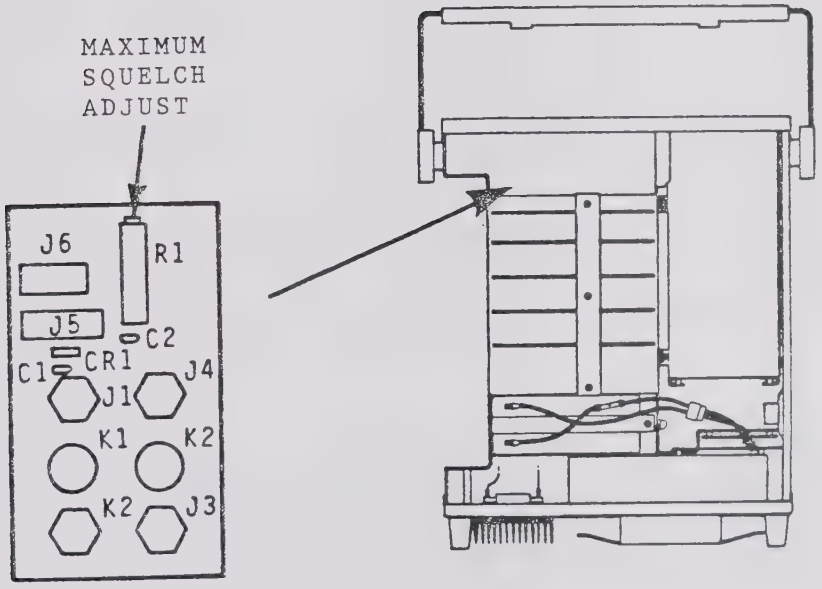


Figure 4-19. 4700 Relay Control Assembly Maximum Squelch Adjustment.

Deviation Meter Adjustment

4.16.5 Set the CE-4000 controls as follows:

a) Set the RECEIVE/GENERATE switch to GENERATE.

b) Set the Function Meter switch to the 15 kHz DEV position.

c) Set the FREQUENCY (MHz) switches to any carrier frequency.

d) Set the MOD ADJ (1 kHz) for 5 kHz deviation from the SIG GEN OUT jack.

4.16.6 Adjust as follows:

a) On the 4400 MOD/DEMOD Assembly (See Figure 4-18), adjust R136 for a reading of 5 kHz on the Deviation Meter.

b) Using the MOD ADJ control, reduce the modulation to 1 kHz deviation and check meter tracking.

c) Change the Function Meter switch to the 1.5 kHz position. The deviation should read 1 kHz $\pm$75 Hz.

d) If necessary repeat steps (a) through (c).

Modulation Out

4.16.7 Set the CE-4000 controls as follows:

a) RECEIVE/GENERATE switch to GENERATE.

b) FREQUENCY (MHz) switches to any carrier frequency.

c) Set the MOD ADJ (1 kHz) control for 5 kHz deviation reading on the function.

4.16.8 Adjust as follows:

On the 4400 MOD/DEMOD Assembly (See Figure 4-18), adjust R120 for 750 mV $\pm$75 mV peak to peak from the DEMOD OUT jack.

Power Meter Driver Adjustment

4.17 Accuracy of the power ranges of the Function Meter depends on proper adjustment of the 4900 Power Meter Driver Assembly. Upon repair or replacement of this board, the following adjustments may be necessary.

4.17.1 Set up the external test equipment as follows:

a) Connect a signal generator to a 150 watt power amplifier.

b) Set the signal generator to 150 MHz.

c) Connect the output of the power amplifier to the CE-4000 SIG GEN OUT jack.

d) Set the CE-4000 Function Meter switch to the 15W position.

4.17.2 Adjust the power meter low range as follows:

a) Set the Signal Generator output to the power amplifier so that the meter on the power amplifier indicates 1.5 watts.

b) Adjust R6 (1.5W adjustment) on the 4900 Power Meter Driver Assembly (See Figure 4-20), for a 1.5 watt reading on the CE-4000 Function Meter.

c) Adjust the Signal Generator output so that the power amplifier output meter indicates 15 watts.

d) Adjust R2 (15W adjustment) on the 4900 Assembly (See Figure 4-20), or a fullscale reading on the CE-4000 Function Meter.

NOTE

Interaction between R2 and R6 may necessitate several adjustments to obtain accuracy.

4.17.3 Adjust the Power Meter high range as follows:

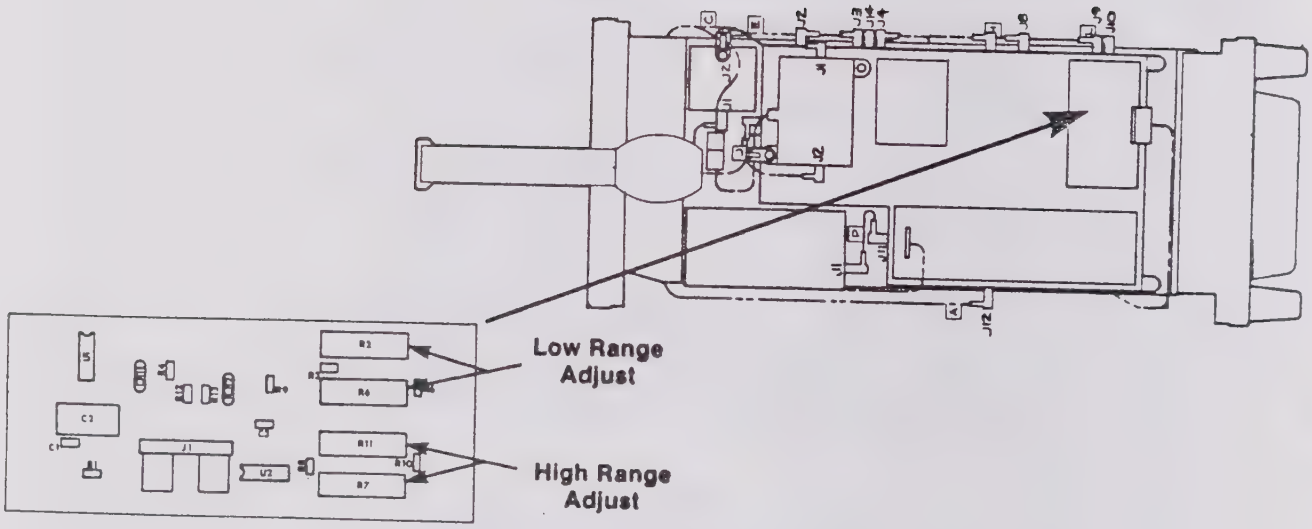
a) Complete steps (a) through (d) of paragraph 4.30 (low range).

b) Set the CE-4000 Function Meter switch to the 150W position.

c) Set the external Signal Generator output to the power amplifier so that the power amplifier output meter indicates 15 watts.

4.17.4 Adjust as follows:

a) Adjust R11 (15W x 10 adjustment) on the 4900 Assembly (See Figure 4-20), for an indication of 15 watts on the CE-4000 Function Meter.



Figured 4-20. 4900 Power Meter Driver Assembly.

b) Increase the Signal Generator output to the power amplifier so that the power amplifier output meter indicates 150 watts.

c) Adjust R7 (150W adjustment) on the 4900 Assembly (See Figure 4-20), for a full-scale indication (150 watts).

NOTE

Interaction between R7 and R11 may necessitate several adjustments to obtain accuracy.

4.17.5 Verify meter tracking as follows:

a) Reduce the power amplifier output power to zero.

b) Set the CE-4000 Function Meter switch to the 15W position.

c) Adjust the Signal Generator and output power to the frequencies and power levels most frequently used.

d) Continue to check meter tracking with the CE-4000 Function Meter switch in the 150W position.

SINAD Meter Adjustment

4.18 Accuracy of the SINAD scale of the Function Meter depends on proper adjustment of the 4800 SINAD Assembly. Upon repair or replacement of this board, the following adjustments may be necessary.

4.18.1 Set up the equipment and controls as follows:

a) Connect a coaxial cable from the CE-4000 DEMOD OUT jack to the CE-4000 SINAD IN jack.

b) Set the CE-4000 RECEIVE/GENERATE switch to GENERATE.

c) Set the CE-4000 Function Meter switch to 15 kHz.

d) Input a 2111 Hz tone into the CE-4000 MOD IN jack.

e) Adjust the CE-4000 MOD IN ADJ control for a 5 kHz deviation on the Function Meter.

f) Set the CE-4000 Function Meter switch to SINAD.

4.18.2 Adjust as follows:

a) Adjust R24 on the 4800 Assembly (See Figure 4-21), for a 0dB indication on the Function Meter.

b) Disconnect the 2111 Hz tone from the CE-4000 IN jack.

NOTE

Do not change tone level, or the following adjustments will be affected.

c) Set the CE-4000 Function Meter switch to 15 kHz DEV.

d) Adjust the CE-4000 MOD ADJ (1 kHz) control for a 15 kHz deviation on the Function Meter.

e) Set the Function Meter switch to SINAD.

f) Adjust R29 on the 4800 Assembly (See Figure 4-21) for 30dB on the Function Meter.

g) Reconnect the 2111 Hz tone; the Function Meter should read 10dB SINAD.

NOTE

Because of interaction between adjustments of R24 and R29, steps (a) through (f) may have to be repeated to obtain accurate indications on the SINAD Meter.

Frequency Accuracy Adjustment

4.19 Frequency accuracy can be affected by the setting of the TCXO on the 4300 Reference Frequency Generator Assembly, or by the 4200 100Hz Synthesizer Assembly. If either the 4200 or 4300 board has been repaired or replaced, the following adjustments may be necessary.

4.19.1 Set up the CE-4000 as follows:

a) Set the RECEIVE/GENERATE switch to GENERATE.

b) Set the MOD ADJ (1 kHz) control to the OFF position.

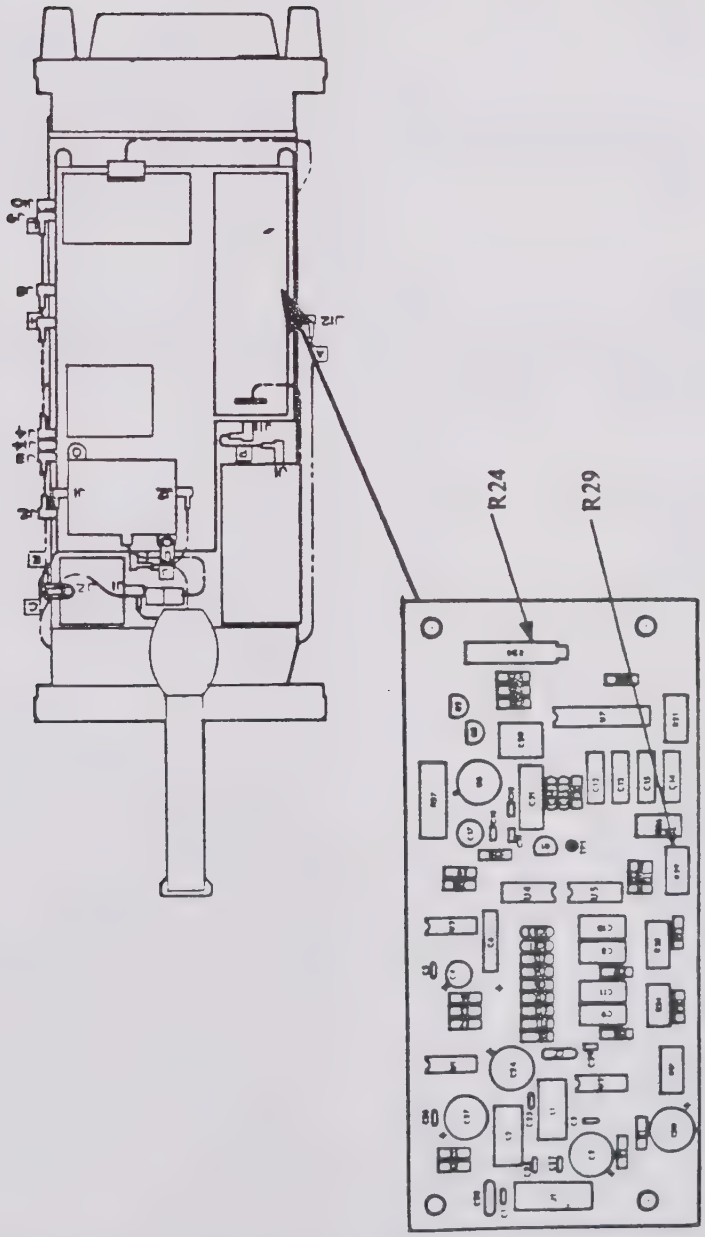


Figure 4-21. 4800 SINAD Assembly Adjustments.

c) Set the SIG GEN LEVEL control to 10 mV (1 mV, with vernier in the X10 position).

d) Set the FREQUENCY (MHz) switch to 000.0000.

e) Adjust the FREQ OFFSET control to center the FREQUENCY ERROR Meter.

4.19.2 Adjust as follows:

a) On the 4300 Reference Frequency Generator Assembly (See Figure 4-22), adjust the trimmer on the TCXO for 45.0000 MHz out of H-Cable (4200 board) at J8 of the 3000 microwave casting (See Figure 4-23).

NOTE

This is a preliminary adjustment only. For final adjustment of TCXO/OCXO, refer to the calibration procedure in Section 5.

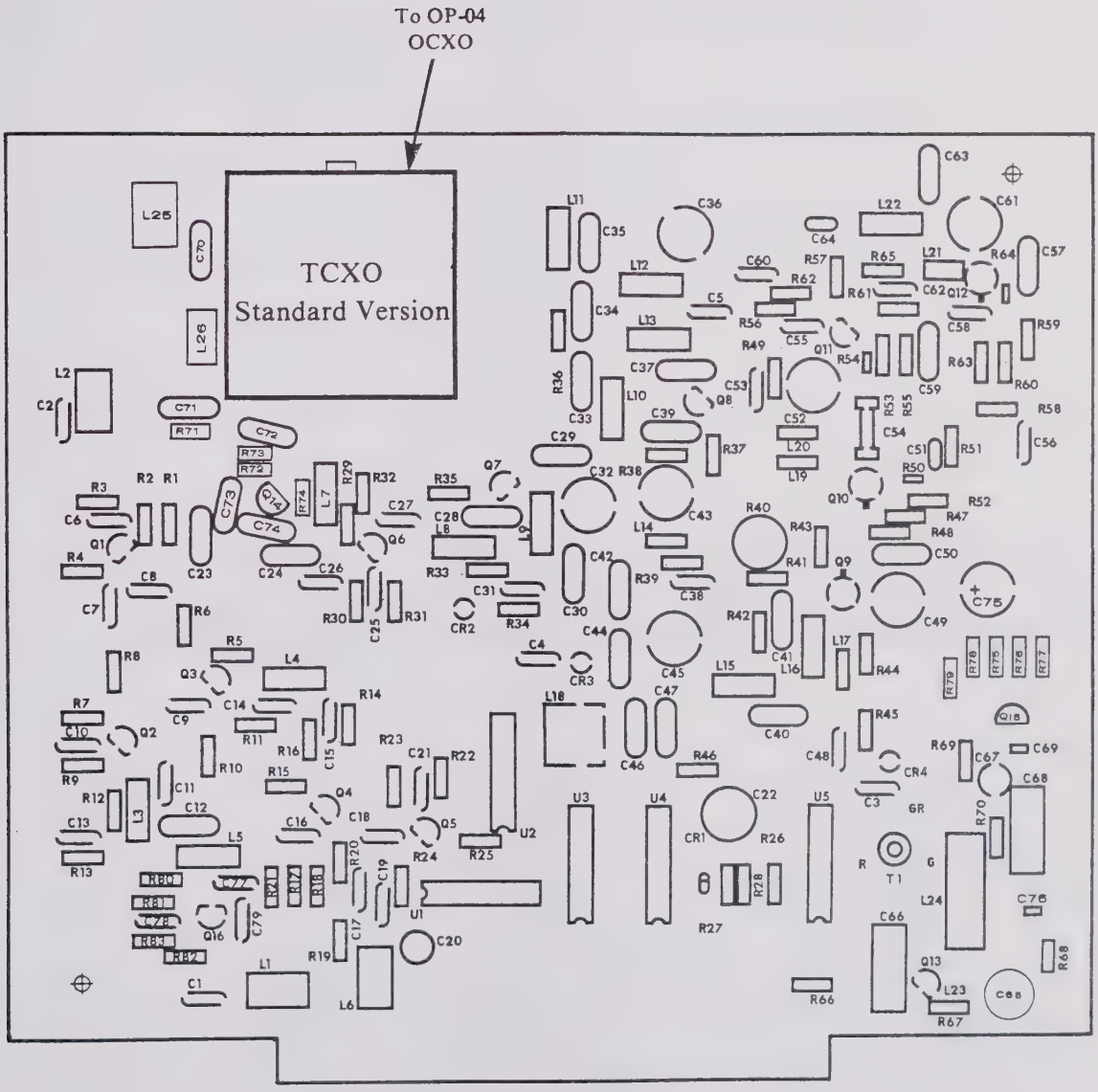


Figure 4-22. 4300 Reference Frequency Assembly TCXO Adjustment.

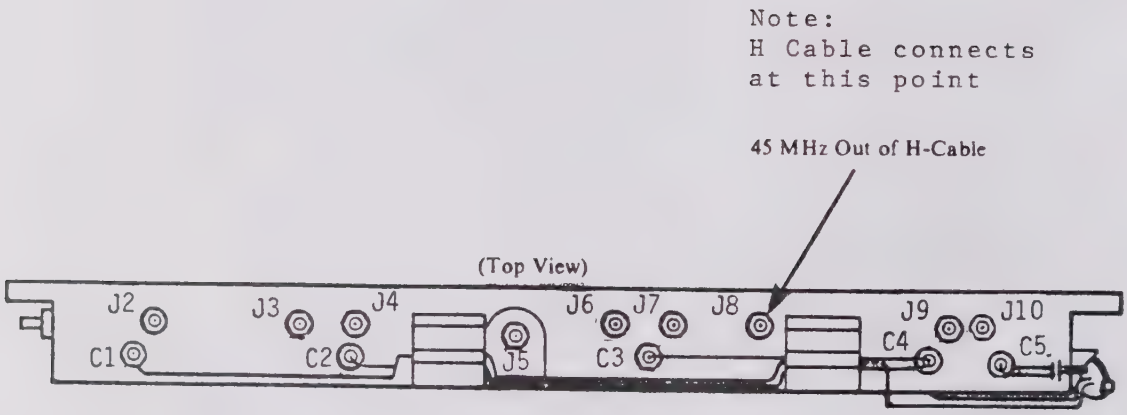


Figure 4-23. 3000 Microwave Casting Assembly Frequency Accuracy Adjustment.

SECTION 5
CALIBRATION PROCEDURES

INTRODUCTION

5.1 The following calibration procedures contain the tests necessary to verify that the CE-4000 accuracy is in accordance with factory specifications.

5.2 Table 5-1 contains a listing of the calibration procedures with corresponding paragraph numbers.

5.3 For complete calibration/verification of the CE-4000 functions, perform these procedures in sequence. Individual calibration procedures may be performed as required.

Table 5-1. Calibration Procedures.

PARA NO.	TEST TITLE
5.6.1	Visual Inspection
5.6.2	Meter Mechanical Zero Adjustment
5.6.3	Power Supply Check
5.6.4	Master Oscillator Adjustment
5.6.5	1.8 GHz Cavity Filter Alignment
5.6.6	YIG PLL Adjustment
5.6.7	YIG Loop Optimization
5.6.8	DAC Linearity Check
5.6.9	100 Hz Synthesizer Check
5.6.10	VHF P11 Check
5.6.11	Discriminator Balance
5.6.12	Oscilloscope Horizontal Sweep Calibration
5.6.13	Scope Mod Output Check
5.6.14	Scope Demod Balance Check
5.6.15	Scope External VERT IN Check
5.6.16	HORIZ CAL/VERT CAL Check
5.6.17	Audio Input Check
5.6.18	Receive Mode Deviation Adjustment
5.6.19	Generate Mode Deviation Adjustment
5.6.20	FM CAL Adjustment
5.6.21	Front Panel Functions
5.6.22	RF Signal Generator Power Calibration
5.6.23	Receive Frequency Accuracy
5.6.24	Battery Circuit Test
5.6.25	TCXO (OCXO) Temperature Compensated Adjustment
5.6.26	Audio Synthesizer (OP-03, 403)
5.6.27	RF Attenuator Accuracy (SIG GEN)
5.6.28	Power Meter Driver Test
5.6.29	SINAD Test
5.6.30	Plug-in Interface Check
5.6.31	OP-04 Check

EQUIPMENT REQUIRED

5.4 To perform the calibration procedures, the following equipment or its equivalent is required:

a) Modulation Analyzer, HP8901A
b) Power Meter, HP436A
c) Power Sensor, HP8484A
d) Power Sensor, HP8482A
e) Digital Voltmeter, Data Precision Model 2480
f) Counter, EIP 371
g) Spectrum Analyzer, HP8554B/8552B
h) Power Supply, HP6125A
i) Signal Generator, HP8640/CE-4
j) Step Attenuator, 1dB/10dB step, HP 8494A/8495A
k) Communications Monitor, CE-4
l) Battery Simulator Test Fixture, Cushman
m) SINAD Test Fixture 5611-0268
n) Distortion Analyzer
o) RF Power Generator, Cushman
p) RMS Voltmeter, Fluke 8920
q) Oscilloscope, HP180
r) Squarewave Generator, Interstate F77
s) Plug-in Test Fixture, Cushman
t) High Level Amplifier, Cushman 7060-0027

INITIAL CONTROL SETTINGS

5.5 Set the front panel controls as indicated in Table 5-2.

Table 5-2. Initial Control Settings.

CONTROL	POSITION
RANGE (kHz)	15 kHz
READ +, -	+
PEAK LEVEL	Mid range
RECEIVE GENERATE	GENERATE
POWER	OFF
FREQUENCY (MHz)	050.0000
SIG GEN LEVEL	10 mV (1mV x 10)
LEVEL	LOW (CAL)
Function Meter	15 kHz DEV
SQUELCH	Fully clockwise
MOD ADJ	MIN
MOD ADJ (1 kHz)	OFF
VOLUME	Fully counterclockwise
GEN OFF	OFF

CALIBRATION PROCEDURES

5.6 Prior to performing the calibration procedures, remove all power from the unit, including the power cord.

Visual Inspection

5.6.1 Visually inspect the unit for evidence of damage. Verify all board retainers and cables are secure.

Meter Mechanical Zero Adjustment

5.6.2 Adjust FREQUENCY ERROR Meter zero adjustment screw for zero indication on the Meter.

5.6.3 Adjust Deviation Meter zero adjustment screw for zero indication on the Meter.

Power Supply Check

5.6.4 Check that the unit is properly fused. Position the rear panel AC/DC switch to AC, and the 115/230V switch to appropriate setting for power source being used.

a) Connect the power cord to the unit and plug the power cord into the appropriate power source.

b) Position the POWER switch on the front panel to on (up). The green POWER LED should light.

e) Verify voltages as indicated in Table 5-3 using a DVM.

Table 5-3. Power Supply Voltages.

J5303 TEST POINT	VOLTAGE	TOLERANCE
PIN 7	+12V	±0.5V
3	+10V	±0.001V
8	+5V	±0.050V
5	-12V	±0.050V

Master Oscillator Adjustment

5.6.5 Perform the Master Oscillator Adjustment as follows:

a) Place the RECEIVE/GENERATE switch on front panel to the RECEIVE position.

b) Apply a 900.0000 MHz signal to the ANT IN connector.

c) Adjust the TCXO (4300 board) so that the FREQUENCY ERROR Meter indicates zero error; or set input frequency to zero and set TCXO/OCXO for 45.000 MHz at H cable output jack (rough adjustment).

1.8 GHz Cavity Filter Alignment

5.6.6 Perform the 1.8 GHz Cavity Filter Alignment as follows:

a) Unplug cable E at casting.

b) Connect a spectrum analyzer to the output of the cavity filter (J2) using an unterminated adapter, and adjust the tuning screw for peak power at 1.8 GHz. It should be $\pm$1.0dBm minimum.

c) Reconnect the cable from J2 of the filter to J7 of the casting. Maximum output should be $\leq$+2dBm.

d) Adjust C12 on the 3200 board if required.

YIG PLL Adjustment

5.6.7 Perform the PLL Adjustment as follows:

a) Place NML-TEST switch on the 4500 Assembly to TEST, and disconnect the YIG.

b) Measure and record the sampler voltage at TP-1 of YIG driver (4500) using a DVM.

c) Move the probe to TP-2 and adjust R12 (DC ADJUST) to obtain the same reading recorded in the previous step.

d) Place the RECEIVE/GENERATE switch in the GENERATE position.

e) Connect the YIG back to J12 and set the FREQUENCY (MHz) switches to 020.000.

f) Connect the SIG GEN output to the Frequency Counter.

g) Return the NML-Test switch on the 4500 Assembly to NML.

h) Frequency counter should indicate 20 MHz. If not, adjust R4 (offset) for 20.00 MHz.

i) Set the FREQUENCY (MHz) switches to 990.000.

j) Verify that the frequency counter indicates 990 MHz.

k) Adjust R1 (GAIN) on the 4500 Assembly for an output frequency of 990.00 MHz.

l) Repeat steps (a) through (k) until correct.

YIG Loop Optimization

5.6.8 Perform the YIG Loop Optimization procedure as follows:

a) Position switch S1 on the 4500 Assembly to NORMAL.

b) Verify that the CE-4000 is locked at 990.000 MHz.

c) Set the FREQUENCY (MHz) switches on the front panel to 020.0000 MHz.

d) Set the voltage for 3.9 volts by adjusting R4 (OFFSET), while measuring TP-9 on the PCB 4500 Assembly.

e) Set the FREQUENCY (MHz) switches to 990.0000 MHz.

f) Set TP-9 to 3.9 volts by adjusting R1 (GAIN).

DAC Linearity Check

5.6.9 Perform the Linearity Check as follows:

Rotate the 100 MHz switch on the front panel FREQUENCY (MHz) switches from 0 to 9 while measuring TP-9 on the 4500 Assembly. The voltage should be 3.9 $\pm$1.2 volts.

100 Hz Synthesizer Check

5.6.10 Perform the 100 Hz Synthesizer Check as follows:

a) Set the SIG GEN LEVEL vernier on the front panel to X10.

b) Adjust the FREQ OFFSET control on the FREQUENCY ERROR Meter for zero frequency error.

c) Set the FREQUENCY (MHz) switches to 050.0000 MHz.

d) Measure the frequency by monitoring the 45 MHz input to the casting (Cable H). The frequency should be 45.0000 MHz.

e) Rotate the 10 kHz, 1 kHz, and 100 FREQUENCY (MHz) switches from 1 to 9; the frequency at the 45 MHz input should change as shown:

50.0000-------45.0000 MHz
50.0111-------45.0111 MHz
50.0999-------45.0999 MHz

VHF PLL CHECK

5.6.11 Peform the VHF PLL check as follows:

a) Place the RECEIVE/GENERATE switch on the front panel in the GENERATE position.

b) Using a scope or DVM, monitor feed-through capacitor C5 on the casting (VCO control voltage).

c) Set the FREQUENCY MHz switches to 040.0000. The voltage should be 8.0 $\pm$0.2 volts and the loop phase locked.

Discriminator Balance

5.6.12 Perform the Discriminator Balance as follows:

a) Position all FREQUENCY (MHz) switches to zero.

b) Place RECEIVE/GENERATE switch in RECEIVE position.

c) Set the FUNCTION switch to the 1.5 kHz DEV position.

d) Adjust R23 on the 4400 Assembly for a zero reading on the Function Meter.

e) Verify that the SIGNAL LEVEL light comes on with the SQUELCH control fully open.

f) Set SQUELCH control to maximum.

g) Adjust potentiometer R1 on Relay Assembly (4700) until the SIGNAL LEVEL light just turns off, then till it just turns on.

h) Check that SIGNAL LEVEL light is off at all other frequencies.

Oscilloscope Horizontal Sweep Calibration

5.6.13 Perform the Oscilloscope Horizontal Sweep Calibration as follows:

a) Set the CE-4000 scope VERT switch to 5 mV EXT position.

b) Set the HORIZ switch to 10 ms.

c) Connect a function generator to EXT VERT INPUT; set the Function Generator for 100 Hz and 30 mv peak to peak.

d) Adjust R42 (HORIZ GAIN) and R3 (RAMP) on the 8200 Assembly to obtain a scan of 11 complete and evenly-spaced sine waves on each of the vertical markings.

e) Check the 9th mark; it should be 9 $\pm$0.2.

f) Set the HORIZ/DIV switch and the square-wave generator as shown in Table 5-2.

g) Check the peak to peak, or peak to trough distance.

Table 5-4. Square-wave Generator Settings.

HORIZ/DIV	GENERATOR FREQ	DISTANCE	TOL.
1 millisec.	111.1 Hz	9 cycles	9 div $\pm$0.2
100 microsec.	1.111 kHz	1 cycle	9 div $\pm$0.2
10 microsec.	11.111 kHz	1 cycle	9 div $\pm$0.2

h) Set the CE-4000 VERT switch to MOD OUT 0.5V, HORIZ switch to 1 ms, AUDIO SYNTHESIZER GEN/OFF switch to GEN, MOD ADJ control to minimum.

i) Adjust MOD ADJ control to obtain a display of 6 waveforms.

j) Adjust R5, on the HVPS PCB Assembly (8300), so that the display does not bloom out with INTENSITY control set fully clockwise.

Scope Mod Output Check

5.6.14 Set the CE-4000 VERT switch to MOD OUT 50 mV, and HORIZ switch to 1 ms.

a) Connect an external test oscilloscope to the MOD OUT jack on the CE-4000 front panel.

b) Adjust the optional tone generator level or the standard 1 kHz tone generator to obtain a 400 mV peak to peak display on the test oscilloscope.

c) Adjust R88 (VERT GAIN) for 8 divisions on the CE-4000 scope.

d) Set the CE-4000 VERT switch to MOD OUT 0.5V.

e) Adjust gain for a MOD OUT of 4V peak to peak on the test oscilloscope.

f) The CE-4000 should show 8 $\pm$0.1 divisions.

Scope Demod Balance Check

5.6.15 Set the CE-4000 VERT switch alternately to 2 kHz and 6 kHz, with no modulation.

a) If the two horizontal traces do not coincide to within 0.1 divisions, adjust R58 (OFFSET).

Scope External VERT IN Check

5.6.16 Center the trace on the CE-4000 scope.

a) Alternately set the VERT switch to MOD OUT 0.5V and 5V EXT.

b) If the two traces do not coincide to within 0.1 divisions, adjust R65 (BAL).

c) Set the VERT switch to EXT 50 mV, and HORIZ to 100 ohms.

d) Connect Square Wave Generator to the CE-4000 VERT IN jack.

e) Set Square Wave Generator for 3 kHz and 400 mV peak to peak.

f) Adjust R79 (EXT VERT GAIN) for 8 divisions on the CE-4000 scope.

g) Check top and bottom of square wave for overshoot or undershoot.

h) Adjust C17 for flat top square wave.

i) Make the checks listed in Table 5-2.

Table 5-5. External Scope VERT IN Checks.

VERT SWITCH	GENERATOR OUTPUT	SCOPE DISPLAY	ADJUST
5.0 mV EXT	40 mV P-P	8 ±0.1 div.	None
0.5 V EXT	4 V P-P	8 ±0.1 div.	C18
5.0 V EXT	15 V P-P	3 ±0.1 div.	C19

HORIZ CAL/VERT CAL Check

5.6.17 Make the HORIZ/VERT CAL adjustment follows:

a) Verify that the horizontal magnitude of the signal is varied by 10 times.

b) Rotate the HORIZ CAL control fully CW from its detent position.

c) Verify that the VERT CAL can vary the vertical magnitude by 10 times or more.

Audio Input Check

5.6.18 Check audio input as follows:

a) Set the VERT switch to 0.5V EXT and HORIZ to INT.

b) Connect the CE-4000 MOD OUT to the VERT IN jack.

c) Set the CE-4000 to GEN and AUDIO SYNTHESIZER to 200 Hz.

d) Turn the MOD ADJ potentiometer halfway CW (about 2.5V peak to peak output).

e) A Lissajous pattern should be seen on the CE-4000 scope.

Receive Mode Deviation Adjustment

5.6.19 Make the deviation adjustment in the RECEIVE mode as follows:

a) Adjust deviation zero control (on the 4400 Assembly) to indicate zero on the Function Meter with no signal into the CE-4000 (Signal Level Light Off).

b) Set the Function Meter switch to 15 kHz DEV, the RECEIVE/ GENERATE switch to RECEIVE.

c) Set the SELECTIVITY switch to WIDE.

d) Apply an FM modulated signal at 67dBm (100 uV) from the Signal Generator to the RF connector.

e) Set the deviation to exactly 6 kHz at a 1 kHz modulation frequency.

f) Connect scope to DEMOD OUT. The level should be greater than 500 mV peak to peak.

g) Adjust R79 on the 4400 Assembly for a reading of 6 kHz on the Function Meter.

h) Switch the CE-4000 scope VERT/DIV switch to the 6 kHz (DEMOD) position.

i) Check that the amplitude of the display is 6 kHz.

j) Adjust R63 on the 4400 Assembly (DEMOD GAIN) for exactly 6 kHz.

NOTE

The meter and the scope must track. Any error on one must show the same error on the other.

k) Reduce deviation to 2.5 kHz. Verify that the tracking of the Deviation Meter is $\pm$150 Hz.

l) Increase level to 15 kHz (full scale) the Meter should read 15 kHz $\pm$750 Hz.

m) Set the Function Meter switch to 1.5 kHz DEV. Adjust the deviation to 1.5 kHz.

n) Adjust R60 on the 4400 Assembly so the CE-4000 Meter reads 1.5 kHz.

o) Set the Scope VERT switch to on the 2 kHz range. It should read 1.5 kHz ± 50Hz.

p) Reduce the deviation to 0.5 kHz. Observe that the CE-4000 Meter reads 0.5 kHz ±50Hz.

Generate Mode Deviation Adjustment

5.6.20 Make the deviation adjustment in the GENERATE mode as follows:

a) Set the CE-4000 FREQUENCY (MHz) switches to 25.0100 MHz.

b) Set the GENERATE/RECEIVE switch to the GENERATE position.

c) Set the MOD ADJ (1 kHz) tone on AUDIO SYNTHESIZER off.

d) Connect the modulation analyzer set for 50 Hz High Pass, 3 kHz Low Pass to the SIG GEN OUT.

e) Adjust the 1 kHz MOD ADJ potentiometer for a reading of 6 kHz peak deviation on the Modulation Analyzer.

f) Adjust R136 of the MOD/DEMOD (4400 Assembly) PCB for a deviation meter reading of exactly 6 kHz.

g) Increase deviation to 15 kHz - check tracking of Deviation Meter. It should be ±1 kHz.

h) Adjust the VOLUME potentiometer fully clockwise at 15 kHz deviation and shake the unit to check for mechanical and electrical microphonics originating in the casting.

i) Switch the Function Meter to 1.5 kHz and adjust the 1 kHz MOD ADJ potentiometer for 1.5 kHz peak deviation reading on the Modulation Analyzer.

j) Verify that the CE-4000 Meter indicates within ±50 Hz accuracy.

k) Reduce the deviation to 0.5 kHz. See that the CE-4000 Deviation Meter indicates 0.5 kHz ±50 Hz.

FM CAL Adjustment

5.6.21 Check Receiver Discriminator Balance as in paragraph 5.6.12, then proceed as follows:

a) Connect the 45 MHz cable (H cable) to a counter and adjust the FM OFFSET for 45.0000 MHz.

b) Reconnect H cable back to casting.

c) Set FREQUENCY ERROR Meter range to 1.5 kHz and connect the SIG GEN to the counter and dial 25.0000 MHz.

d) Adjust the FREQ OFFSET potentiometer until the frequency is exactly 25.0000 MHz.

e) Adjust R128 of 4400 Assembly to get zero error reading on the Meter.

f) Dial the FREQUENCY (MHz) switches to 316.1111 and 469.4444 MHz (with FREQUENCY ERROR Meter at zero) and check if the frequencies are within $\pm$150 Hz measured from the counter.

g) Set the FREQUENCY (MHz) switches to 25.0100 MHz, with no modulation.

h) Adjust the FM CAL (OFFSET) for a +10 kHz reading on the Meter. The frequency counter should read 25.020 MHz $\pm$1000 Hz.

i) Adjust the Meter for -10 KHz reading and count the frequency. It should be 25.000 MHz $\pm$1000 Hz.

j) Observe that the Meter goes "off-scale" at each end of travel with frequency offset potentiometer.

k) Set the RANGE to 1.5 kHz and adjust the frequency error for zero.

l) Count the frequency.

Front Panel Functions

5.6.22 Check the following front panel functions:

a) PEAKS Indicator - Increase the 1 kHz MOD ADJ for a deviation of 12.5 kHz with the CE-4000 in the GENERATE mode and the +/- switch in the + position.

b) Adjust the PEAK LEVEL until the PEAKS LED just goes out. Any increase in deviation should cause the light to come on.

c) Repeat step b) with +/- switch in the - position, and set the +/- switch back to the + position.

d) Audio Amp/Speaker - Adjust the VOLUME control from MIN to MAXIMUM (full CW), with a modulation tone of 1 kHz and deviation of 15 kHz in RECEIVE mode. The volume should go from off to full.

e) Repeat the check in GENERATE mode; remain in GENERATE mode.

f) MOD OUT - Monitor the MOD OUT with an oscilloscope, while increasing the 1 kHz MOD ADJ to maximum, measure the amplitude. It should be >8.0V peak to peak.

g) Check demod out of >0.3V.

h) MOD IN - Rotate the MOD ADJ control fully CW.

i) Using a "T"-connector, feed audio signal into MOD IN and a scope with tone GEN switch "on," but no internal modulation. An input of <450 mV peak to peak should cause deviation of 15 kHz.

RF Signal Generator Power Calibration

5.6.23 Perform Signal Generator power calibration as follows:

a) Dial up 950.000 MHz in GENERATE mode and set the front panel to exactly 10 mV.

b) Connect the Power Meter with HP8484 sensor directly to the SIG GEN output jack with no cable in between.

c) Adjust the RF LEVEL potentiometer (R61) for a -27dBm reading on the Power Meter.

d) Frequency Compensation Adjustment - Dial up the 100 MHz digit from 8 to 0 inclusive.

e) Set potentiometers 8 to 0 on the output level calibration (2400) Assembly to get -27dBm output as read on a Power Meter.

f) Adjust potentiometer 8 to set the level at 850 MHz; potentiometer 7 to set the level at 750 MHz, etc.

g) Recheck frequency steps. They should all be within ±0.2dB.

h) Connect the Spectrum Analyzer to SIG GEN OUT.

i) Set the FREQUENCY (MHz) switches to 358.000 MHz. Observe that harmonic spurs are <40dBc, and that non-harmonic spurs are -20dBc.

j) Check for spurs (as close in as 100 kHz and as wide as 1 GHz) and harmonics over the entire frequency range.

k) Change power sensor to HP8482A. Switch LEVEL to HIGH and vernier to 10 mV. Output power should be ≥ -1dBm at any frequency from 400 kHz to 999 MHz, especially at 25.0000, 358.0000, 570.5555, 803.8888, and 914.9999 MHz.

l) Connect Analyzer to SIG GEN and the spurious should be <20dBc.

m) Turn RF vernier to OFF.

n) Check for spurious signals in the range of 1000 to 300 MHz; should be <-50dBm.

o) Vernier Calibration - Set frequency back to 50 MHz and set RF output to 10 mV.

p) Set reference on Spectrum Analyzer using 1dB log.

q) Check level for vernier setting as listed in Table 5-6.

Table 5-6. Vernier Calibration Settings.

RANGE	VALUE	TOL.
x10	0dB REF	---
x8	-1.9dB	±1dB
x6	-4.4dB	±1.5dB
x4	-8.0dB	±1.5dB
x2	-14dB	±1.5dB
x1	-20dB	±0.5dB
OFF	<-60dB	

r) Switch to RECEIVE and dial 150 MHz.

s) Remove the "H" cable and check the level of the 45 MHz signal.

t) Adjust R141 (LO Level) on the 4200 Assembly for -5dBm ±1dB.

RECEIVE Frequency Accuracy

5.6.24 Perform the RECEIVE Frequency Accuracy Test as follows:

a) Set the CE-4 to a level of 100 uV.

b) Set the RECEIVE/ GENERATE switch to RECEIVE.

c) Dial up the following frequencies and verify that the FREQUENCY ERROR Meter reads less than maximum allowable error (in the 1.5 kHz position).

d) Check that the residual noise (in NARROW bandwidth) is ≤80 Hz at frequencies listed in Table 5-7.

Table 5-7. Receive Frequency Accuracy Residual Noise Checks.

Frequency (MHz)	Maximum Allowable Error (Hz)
25.0000	±50
136.1111	±100
247.2222	±150
358.3333	±200
469.4444	±250
570.5555	±300
681.6666	±350
792.7777	±400
803.8888	±450
914.9999	±500

e) FREQUENCY ERROR Meter Tracking - Set the CE-4000 to 25.0110 MHz.

f) Set the FUNCTION switch to CW and use Table 5-8 to check tracking:

Table 5-8. FREQUENCY ERROR Meter Tracking

15 kHz Range	
25.0010 MHz	±10 kHz ±1 Div.
25.0210 MHz	±10 kHz ±1 Div.

1.5 kHz Range	
25.0100 MHz	±1 kHz ±1 Div.
25.0120 MHz	±1 kHz ±1 Div.

g) Sensitivity Check - Set the Generator to 2.5 uV and 3.3 kHz deviation at 1 kHz.

h) Check SINAD for 12dB or better at the following frequencies.

Frequency (MHz)	
40.0234	59.9234
167.4567	
458.7912	
876.2145	

i) Input 100 uV and check for ≤100 Hz residual noise at the same frequencies. (WIDE/NARROW switch set to NARROW.)

j) Reduce input to 20 uV and check that the residual noise is <300 Hz at 59.9234 MHz and 458.7912 MHz.

k) Dial the CE-4000 to 25.1111 MHz and set the RECEIVE mode and SELECTIVITY switch to NARROW.

l) Connect the HP8640 to the RF IN of the CE-4000.

m) Set the HP8640 to the following: 25.1111 MHz, 30 uV, 1 kHz tone and 5 kHz deviation.

n) Measure the distortion at the DEMOD OUT jack, using a distortion analyzer.

o) Adjust L3, L8 and matching potentiometer (R50) of the 4500 Assembly for less than 2% minimum distortion.

p) Increase level to 0dBm. Check for less than 5% distortion.

q) Reduce the level to 300 mV.

r) Set the SELECTIVITY switch to WIDE.

s) Check for less than 2% distortion.

Battery Circuit Test

5.6.25 Perform the Battery Circuit Test as follows:

a) If unit is equipped with a battery, connect a DC power supply in place of internal battery.

b) Set the voltage to 13.5V, and the BATTERY/EXT DC switch to BATTERY.

c) Reduce voltage to 11.0V and calibrate the BATTERY Meter for a center scale reading (white area in the center of the Meter) using R22 BAT MTR ADJ (5300 Assembly).

d) Turn off DC power.

e) Remove battery circuit fuse and connect a milliammeter (in-line) to the fuse terminals.

f) Turn on DC power.

g) Adjust power supply for 13.5V. The charge current indicated on the milliammeter should be between 400 and 700 mA at start of charge, and then drop to >50 mA. The voltage across the battery should be 14.2V; if not, adjust charge level using R17.

h) Turn off and disconnect DC power supply, millammeter, and replace battery circuit fuse.

i) Reconnect the battery and check for normal operation.

TCXO (OCXO) Temperature Compensated Adjustment

5.6.26 Perform the following steps:

NOTE

If the unit has an OCXO in place of a TCXO, perform step b-6. If the unit has a TCXO with "Set to XXX.X at 41°C" marked on top, perform steps b-2, 7, and 8; otherwise perform steps b-1 through b-5.

a) Turn off the CE-4000 and allow the instrument to cool to room temperature for a minimum of two hours.

b) Ensure generating source is locked to the in-house standard 1 MHz signal. Perform the following checks using a C-50 as a generating source.

1) Switch the CE-4000 to MONITOR mode and apply the CE-50 SIG GEN output to the CE-4000 RF input. Dial up 950.0000 MHz on the CE-4000 front panel and the synthesizer. Record frequency error on the CE-4000 FREQUENCY ERROR Meter in the 1.5 kHz range.

2) Allow CE-4000 to warm-up with covers installed for a minimum of two hours.

3) Record frequency error on the CE-4000 FREQUENCY ERROR Meter in the 1.5 kHz range.

4) Determine the window of frequency drift from recorded data in steps 1 and 3.

5) Compensate for the TCXO adjustment on the CE-4000 so that the window determined in step 4 is centered about "0" frequency error on the CE-4000 FREQUENCY ERROR Meter. If the error of step 1 was -200 Hz, adjust for -50 Hz. If the error for step 3 was -100 Hz, adjust for +50 Hz. The error window is now centered about "0". Go to step 3.

6) OCXO - Adjust to frequency after 1 hour warm-up. Go to step C.

7) Connect a counter to the 200 MHz cable. Set the TCXO to the frequency marked on the cover X20, i.e., if the "set to" frequency is +21.4. The frequency at 200 MHz should be 21.4 x 20 = 428 or 200.000428 MHz. If the "set to" frequency is -14.7 then the 200 MHz should be -14.7 x 20 = -294 and 200.000000 MHz -294 = 199.999706 MHz.

NOTE

Cover must have been on for a minimum of 2 hours (41°C). Adjustments and test must be made quickly so TCXO doesn't cool.

8) Record the 200 MHz frequency. Turn unit off and let cool for 2 hours. Turn unit on. Warm-up for 1 minute. Measure the 200 MHz signal and record. The difference between hot and cold frequency should be less than 150 Hz at 200 MHz.

NOTE

A frequency drift of more than 150 Hz (at 200 MHz) is cause for rejection.

c) Put cover on, allow 1/2 hour warm-up and re-check. The error should be <100 Hz.

Audio Synthesizer (OP-03)

5.6.27 Perform the following Audio Synthesizer check:

a) While in GENERATE mode adjust the MOD ADJ (1 kHz) control to a minimum and switch Audio Synthesizer section switch to GEN.

b) Adjust MOD ADJ control fully clockwise and dial in 0999.9 Hz. The Deviation Meter should read no less than 15 kHz deviation.

c) Measure the frequency at 9999 Hz, 8888 Hz, on down to 1111 Hz and also at 750, 500, 250, and 100 Hz. Make sure the frequency is within ± 1 ppm.

d) Dial 1000.0 Hz and measure the distortion at MOD OUT. It should be less than 2%.

RF Attenuator Accuracy (SIG GEN)

5.6.28 To check RF Attenuator accuracy, perform the following:

a) Set the CE-4000 Frequency (MHz) switches to 50 MHz.

b) Connect the SIG GEN OUT through a step attenuator, to the input of a high-level amplifier, and connect a cable from the amplifier output to a Spectrum Analyzer.

c) Set the Attenuator to 80dB. Set to 1dB/DIV, Horizontal set to 10 kHz/DIV., Selectivity to -20.

d) Set a reference on the Spectrum Analyzer to the -10dB line with CE-4000 SIG GEN LEVEL switch in 1 mV position.

e) Step the Attenuator down each position.

f) Verify 20dB ±1dB drop on the Spectrum Analyzer for each step.

g) Repeat the check at 450 MHz and 950 MHz.

Power Meter Driver Test

5.6.29 To check the Power Meter Driver accuracy, perform the following:

a) Set an HP8640 Signal Generator to 150 MHz and attach it to the 150W Power Amplifier.

b) Attach the output of the Power Amplifier to the SIG GEN OUT jack on the CE-4000.

c) Set the CE-4000 Function Meter switch to the 15W power position.

d) Turn off the HP8640 Signal Generator so the Power Meter on the Power Amplifier indicates a 0 watt output. If the CE-4000 Power Meter does not read 0 watts then adjust R6 (1.5 adj) so the Meter JUST does read 0 watts.

NOTE

Adjust R6 until needle JUST stops moving. DO NOT adjust any further.

e) Turn on and adjust the HP8640 Signal Generator output so the Function Amplifier output meter reads 15 watts. The CE-4000 Power Meter should also read 15 watts. If not, adjust R2 (15W adj) to give the CE-4000 meter a full scale reading.

f) Potentiometers R2 and R6 affect each other. Repeat steps (a) and (g) several times to achieve good accuracy.

g) Set the CE-4000 Function switch to the 150 watt power range. With the Power Amplifier level at 0 watts the CE-4000 should read 0 on the meter scale. If not, adjust R11 (15W X 10 adj) for JUST 0 watts. (Until meter JUST stops moving. DO NOT adjust any further).

h) Increase the HP8640 Signal Generator and Power Amplifier until it indicates an output of 150 watts on its meter.

i) Adjust R7 (150W adj) for a correct reading if the CE-4000 Function Meter does not show a reading of 150W.

j) Potentiometers R11 and R7 affect each other. Repeat steps (g) and (h) several times to achieve good power meter accuracy.

k) Set the CE-4000 Function switch to the 15 watt power position.

l) Adjust the HP8640 output to the following level to check meter tracking.

2 ±1 watts
4 ±1 watts
8 ±1 watts
12 ±1 watts

m) Set the CE-4000 FUNCTION switch to the 150 watt power position.

n) Adjust the HP8640 output to the following levels to check meter tracking:

20 ±10 watts
40 ±10 watts
80 ±10 watts
120 ±10 watts
140 ±10 watts

o) Turn off RF power.

p) Set the CE-4000 RECEIVE/GENERATE switch to GENERATE.

q) Turn on and slowly increase RF power into the CE-4000.

r) Verify that the relay switches before a 0.5W level is exceeded. The HIGH LEVEL LED is a useful indicator of when the relay switches if the LEVEL switch has been set to HIGH before this test is begun.

Input Frequency	Input Power Level	
	15W Scale	150W scale
50 MHz	13W ±1.1W	130W ±11W
450 MHz	13W ±1.1W	130W ±11W
830 MHz Input	12W ±2.2W	120W ±22W

NOTE

Heatsink must be cool before starting this next step.

s) Increase RF power to 150W at 150 MHz, and verify that the over-temperature audio indicator gives its alarm at greater than 5 minutes and before 10 minutes after this test is begun. Do not input power at this level beyond 10 minutes.

SINAD Test

5.6.30 The SINAD test checks the ability of the CE-4000 to measure the ratio of the signal, plus noise, plus distortion (SINAD) for a receiver. This test is not intended to conform to EIA standards, but is used for checking the Function Meter and SINAD 1 kHz notch filter.

5.6.31 Perform the SINAD test as follows:

a) Connect a cable from the CE-4000 MOD OUT jack to the SINAD IN jack on the front panel.

b) Set the AUDIO SYNTHESIZER MOD ADJ control to MIN.

c) Set the RECEIVE/GENERATE switch to GENERATE.

d) Set the Function Meter switch to the 15 kHz DEV position.

e) Set the AUDIO SYNTHESIZER MOD ADJUST (1 kHz) control for a 15 kHz deviation indication on the Function Meter.

f) Set the GEN/OFF switch on the AUDIO SYNTHESIZER to GEN.

g) Set the deviation on the Function Meter to 12 kHz.

h) Set the Function Meter switch to SINAD.

i) Set the AUDIO SYNTHESIZER frequency to 2111 Hz.

j) The Function Meter should indicate 0dB.

k) Set the AUDIO SYNTHESIZER frequency to 945 Hz.

l) The Function Meter should indicate -20dB.

m) Set the AUDIO SYNTHESIZER frequency to 5340 Hz.

n) The Function Meter should indicate -12dB.

o) Set the AUDIO SYNTHESIZER frequency to 4041 Hz.

p) The Function Meter should indicate -10dB.

Plug-in Interface Check

5.6.32 Perform the following:

a) Install the Plug-in test fixture into the CE-4000.

b) Set the CE-4000 in GENERATE mode, no modulation.

c) Check the four voltmeters on the fixture. They should all be reading at or near center.

d) Check to see if 1 kHz, Generator Override and REC KILL switches are in NORMAL position. All LED lights should be off.

e) Check the 10 MHz Meter. It should be in the green area.

f) Switch the 1 kHz to ON. The Deviation Meter on the CE-4000 should read 10 kHz $\pm$4 kHz.

g) Check the MOD OUT and DEMOD LED lights, they should be ON.

h) Switch Generator Override switch ON. The CE-4000 should switch to RECEIVE mode and the RECEIVE LED light should light and the DEMOD LED should turn off.

i) Open and close the squelch with the CE-4000 SQUELCH control. The SQUELCH LED should turn on and off. Leave the SQUELCH so the SQUELCH LED is off.

NOTE

The 75 kHz LED may or may not be on.

j) Dial 000.0000 MHz on the CE-4000. The SQUELCH LED and the 75 kHz LED should be on.

k) Switch REC KILL to on and the squelch LED should turn off.

l) Connect a 10.7 MHz signal to the 10.7 MHz input.

m) Set the level to -30dBm and SQUELCH control midpoint. The 75 kHz LED and the SQUELCH LED should be on.

n) Connect a spectrum analyzer to the LO connector.

o) Check for levels between 0dBm and -30dBm as the 100 MHz frequency dial is switched from 0 to 900 MHz.

OP-04 Check

5.6.33 If the unit is equipped with the OP-04 perform the following:

NOTE

All adjustments are made on PCB Assembly 4600 (7001-0786).

a) Oscillator Frequency Adjust - Switch the CE-4000 to RECEIVE mode.

b) Set the frequency entry switches to 000.0000 MHz.

c) Adjust C12 so the IF FREQUENCY LCD reads 5000 exactly.

d) Frequency Meter Tracking - Verify that the IF FREQUENCY LCD meter tracks the frequency error as follows:

CE-4000 Frequency	IF FREQUENCY LCD
000.0001 MHz	5100 Hz
000.0012 MHz	6200 Hz
000.0123 MHz	7300 Hz

e) Display Blanking - Switch the CE-4000 to GENERATE mode. The IF FREQUENCY LCD should read 00.

f) Logvoltmeter Adjustments - Adjustments of the logvoltmeter section is an interactive process.

g) Repeat the following steps until the proper accuracy is achieved for all three adjustments.

1) Zero Adjust - Attach a Fluke 8920 RMS Voltmeter to the DEMOD OUT jack on the CE-4000. Adjust a 1 kHz tone until the Deviation Meter (1.5 kHz range) reads 1 kHz of deviation. Set R10, OdB SET, so the DEVIATION LEVEL (dB) LCD reads 00.0. Now set the OdB reference on the Fluke RMS Voltmeter.

2) Range Set - Switch the CE-4000 Function Meter switch to the 15 kHz deviation range. Increase the 1 kHz tone level until the Deviation Meter is set to about 5 kHz. Adjust R19, RANGE SET, so the DEVIATION LEVEL (dB) LCD displays the same value as the Fluke Meter $\pm$0.15dB. Check that 0.5 kHz deviation indicates -6dB $\pm$0.2dB, 1 kHz deviation indicates OdB and 5 kHz indicates $\pm$14dB $\pm$0.2dB.

3) Level Set - Set the CE-4000 Function Meter switch back to the 1.5 kHz range. Adjust the 1 kHz tone level for about 0.3 kHz of deviation. Adjust R2, LEVEL SET, so the DEVIATION LEVEL (dB) LCD reads the same as the Fluke Meter $\pm$0.15dB.

4) Frequency Response - Deviation set to 5 kHz note the level on the digital display of the OP-04. Change the tone to 100 Hz and then to 4 kHz. The Meter should not change more than $\pm$0.4dB.

SECTION 6
DRAWINGS AND PARTS LISTS

INTRODUCTION

6.1 This section contains schematics, component location drawings, and parts lists for each circuit board assembly of the CE-4000 Radio Communications Test Set.

CIRCUIT REFERENCE SERIES

6.2 The Circuit Reference Series is a series of numbers assigned to the circuits of the instrument to make it possible to relate the actual circuit board or assembly to the schematic diagrams, the parts lists, and the text of the manual.

6.3 The series of numbers assigned to the CE-4000 are as follows:

1000 Front Panel Assembly
2000 Module Assembly, Attenuator
3000 Microwave Casting
4000 PCB Assembly, Main Interconnect
5000 Power Suppply
7000 Module Assembly, High Level Amplifier
8000 Module Assembly, Oscilloscope

6.4 Under each main grouping, the circuits are further divided into 4-digit number groups (e.g., 4100, 4200, 4300), each of which represents a circuit board assembly. On each circuit board, the components are individually numbered in a series starting with 1, each type having a separate series, as designated by a letter or letters. The complete reference to any component includes the circuit reference number, the individual component number, and the letter type indicator. For example, the first resistor, R1, in the 2100 circuit will be R2101; the second transistor, Q2, will be Q2102, etc. The printed circuit board plugs and connectors are similarly designated, with pin numbers following the component reference number, separated by a dash. For example, the first plug for the 2100 circuit would be P2101, and pin 4 of that plug would be P2101-4.

6.5 Table 6-1 is a quick cross reference for locating information about a particular Printed Circuit Board (PCB) Assembly. The PCBs are listed sequentially by board assembly number, board name, and Cushman part number. Table numbers for the parts list, figure numbers for component location diagrams, and figure numbers for the schematic diagrams are also listed.

Table 6-1. PCB Assembly.

PCB ASSY.	PART NAME	PART NO.	TABLE NO.	FIG. NO.
	Front Panel Interconnect Diagram			6-1
1000	Main Interconnect Diagram			6-2
1300	Receive/Generate Switch Assembly	7001-0802	6-2	6-3 6-4
2000	Interconnect Diagram Attenuator Assembly			6-5
2100	Attenuator Assembly	7001-0647	6-3	6-6 6-7
	Interconnect Diagram RF Output Casting	8000-0905		6-8
2300	Output Protect/ Power Detect	7001-0799	6-4	6-9 6-10
2400	Output Level CAL	7001-0804	6-5	6-11 6-12
3000	Microwave Casting Interconnect Diagram			6-13
3100	VHF VCO	7001-0641	6-6	6-14 6-15
3200	1.8 GHz Multiplier	7001-0642	6-7	6-16 6-17
3300	2 GHz IF	7001-0643	6-8	6-18 6-19
3400	20 MHz Sampler	7001-0644	6-9	6-20 6-21
3500	Final Mixer/Low Pass Filter	7001-0645	6-10	6-22 6-23
3600	Receiver/Converter	7001-0807	6-11	6-24 6-25

Table 6-1. PCB Assembly Drawing Reference. (Concluded)

PCB ASSY	PART NAME	PART NO.	TABLE NO.	FIG. NO.
3950	Receiver Converter Regulator	7001-0813	6-12	6-26 6-27
4100	Divide-By-M PLL	7001-0632	6-13	6-28 6-29
4200	100 Hz Synthesizer	7001-0815	6-14	6-30 6-31
4300	Reference Frequency Generator	7001-0797	6-15	6-32 6-33
4300	Reference Frequency Generator (OP-04)	7001-0798	6-16	6-34 6-35
4400	MOD/DEMOD	7001-0826	6-17	6-36 6-37
4500	YIG Driver/10.7 MHz IF	7001-0806	6-18	6-38 6-39
4700	Relay Control	7001-0851	6-19	6-40 6-41
4800	SINAD	7001-0800	6-20	6-42 6-43
4900	Power Meter Driver	7001-0801	6-21	6-44 6-45
5000	Power Supply Interconnect	7046-0074		6-46
5100	Power Supply, Rear Panel	7003-0171	6-22	6-47 6-48
5200	DC Switcher	7001-0794	6-23	6-49 6-50
5300	Linear Regulator	7001-0781	6-24	6-51 6-52
7100	High Level Amplifier	7001-0736	6-25	6-53 6-54
8200	Oscilloscope	7001-0790		6-55 6-56
8300	H.V. Power Supply	7001-0769	6-26	6-57 6-58

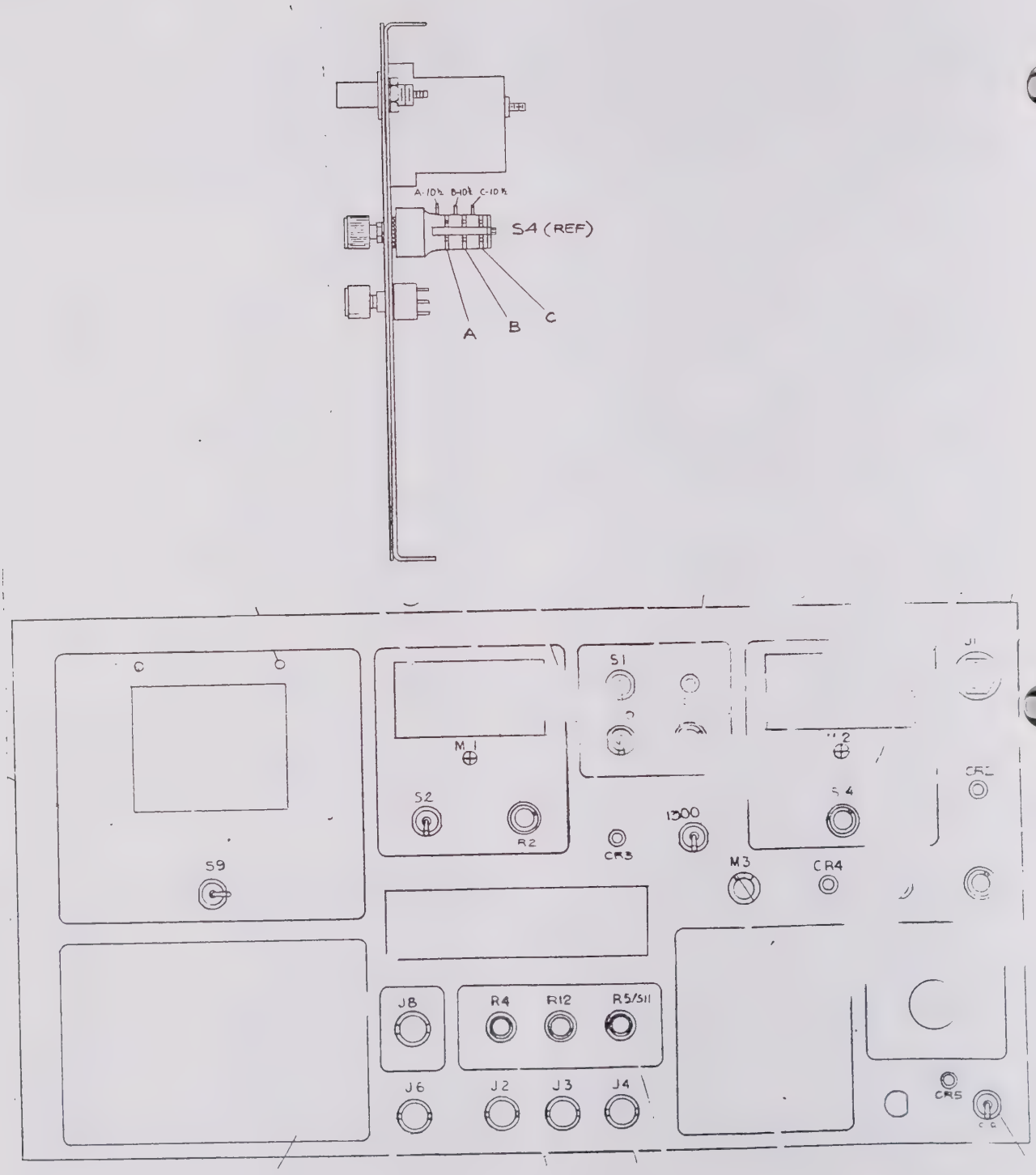
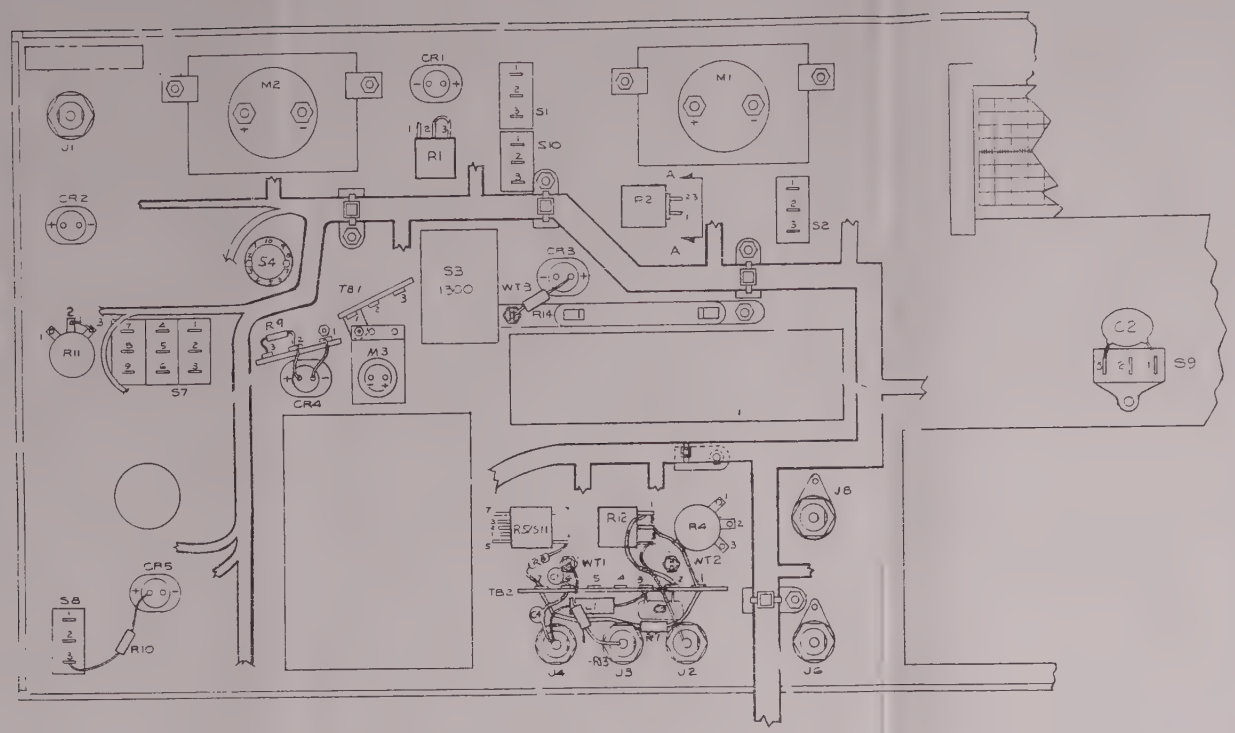


Figure 6-1. Front Panel Interconnect Diagram



R2
VIEW A-A

REAR VIEW

WIRING HARNESS
TERMINATION TABLE I

LINE NO.	REF DESIG	PIN NO. OR SIGNAL	WIRE COLOR OR TYPE
1	R4	1	LBL 1 & G PIGTAIL
2	R4	3	LBL 6 CENTER COND
3	S4	2	LBL 1 CENTER COND
4	TB2	2	BLK (4 WIRES)
5	TB2	4	YEL (5 WIRES)
6	TB2	5	GRN (3 WIRES)
7	TB2	7	GRA / ORN
8	TB2	2	YEL / BLK
9	TB2	7	LBL 4 CTR COND.
10			
11	RS/S11	1	LBL 5 PIGTAIL
12	RS/S11	3	LBL 5 CTR COND
13	S2	2	WHT BLK
14	S2	3	BLK
15	R2	3	GRN
16	R2	1	WHT / GRN
17	M1	-	BRN (-LUG)
18	M1	(+)	RED (LUG)
19	R1	1	
20	R1	3	BLK
21	CR1	(+)	GRN
22	CR1	(-)	WHT / GRN
23	S1	2	BLK / ORN
24	S1	1	BLK
25	1300	1	YEL (5 WIRES)
26	1300	7	YEL / RED
27	1300	8	YEL / RED
28	1300	9	YEL / BLK
29	1300	2	BLK WHT
30	1300	3	YEL / BLU
31	1300	4	BLK ORN
32	1300	5	WHT
33	1300	10	GRN / ORN
34			
35	M2	(+)	WHT
36	M2	(-)	GRN
37	CR2	+	GRN
38	CR2	(-)	WHT BLK
39	CR3	(-)	RED GRN
40	J4	-	LBL 75 CTR COND
41	WT1	-	LBL 76 CTR COND
42	WT2	-	LBL 77 (4 WIRES)
43	WT3	-	YEL / BLU [2]
44			
45	J4	-	LBL 77 CTR COND
46	WT1	-	LBL 5 CTR COND [9]
48	J4	-	LBL 5 CTR COND. [9]

(CONT.)

TABLE I (CONT.)

49	TB1	1	BLK (4 WIRES)
50	TB1	2	RED / WHT
51	TB1	3	BLK / WHT
52	R11	1	BLK
53	R11	2	RED WHT
54	CR5	-	BLK
55	S3	1	YEL / RED
56	S3	2	YEL / BLK
57	S3	3	WHT / GRN
58			
59			
60	TB2	6	LBL 17 PGTL
61	TB2	6	LBL 75 PIGTAIL
62	TB2	6	LBL 76 PIGTAIL
63			
64	S7	9	YEL, WHT
65	S7	2	RED
66	S7	3	RED/GRN (2 WIRES)
67	S7	4	YEL / RED
68	S7	5	BLK
69			
70	S7	8	YEL BLK
71	S4	A-10½	WHT [7]
72	S4	B-10½	GRN [7]
73	S4	C-4	BLK [7]
74	S4	A-4	RED [7]
75	S4	B-1	BLK / ORN [7]
76	S4	B-2	BLK, WHT [7]
77	S4	B-3	GRY [7]
78	S4	C-0½	RED/GRN [3] [7]
79	S4	A-1	RED/WHT [7]
80	S4	A-2	RED/GRN [7]
81			
82	J6	-	LBL 77 CTR COND
83	J6	GROUND LUG	LBL 77 PGTL
84	J6	-	LBL 79 CTR COND
85	J6	GROUND LUG	LBL 79 PGTL
86	J8		LBL 78 CTR COND
87	J8	GROUND LUG	LBL 78 PGTL
88	TB3	1	BLK (4 WIRES)
89	TB3	"	YEL (3 WIRES)
90			
91	S9	1	LBL 74 CTR COND
92	S9	GROUND LUG	LBL 74 PGTL
93			
94			
95	S10	2	YEL / BLK
96	S10	1	YEL
97			

JUMPER TABLE II

LINE NO	ITEM	FROM	TO	LENGTH
1	(65) 4 (R7)	TB2-7	TB2-1	
2	1 (C1)	WT1	TB2-6	
3	54 (LL1)	TB2-3	J4	
4	3 (RB)	TB2-7	RS/S11-4	
5	53 (C3)	TB2-2	TB2-3	
6	25 (BLK WIRE)	TB2-6	R12-1	1.50
7	56 (BRN WIRE)	TB2-1	R12-2	
8	5 (R10)	S8-3	CR5 (+)	
9	50 (C2)	S9-1	S9-3	
10	5 (R9)	TB3-2	TB3-3	
11	34 (R13	WT1	J3	
12	64 (R14)	CR3 (+)	WT3	
13	(RED WIRE)	M3 (+)	TB1-2	1.50
14	(BLK WIRE)	M3 (-)	TB1-3	1.50
15	25 (BLK WIRE)	TB1-1	S3-3	3.00

TABLE II (CONT.)

16	56 (BRN WIRE)	J2	R12-3	
17	65 (SLEEVING)	CR4 (+)	TB3-2	
18	65 (SLEEVING)	CR4 (-)	TB3-1	
19	45 (BUS WIRE)	S4-C-4	S4-B-4	
20	45 (BUS WIRE)	S4-A-3	S4-B-4	
21	45 (BUS WIRE)	S4-B-4	S4-B-5	
22	45 (BUS WIRE)	S4-A-4	S4-A-5	
23	45 (BUS WIRE)	R2-2	R2-3	
24	45 (BUS WIRE)	RS/S11-5	RS/S11-2	
25	68 (C4)	J4	TB2-6	

Figure 6-1. Front Panel Interconnect Diagram (Cont'd)

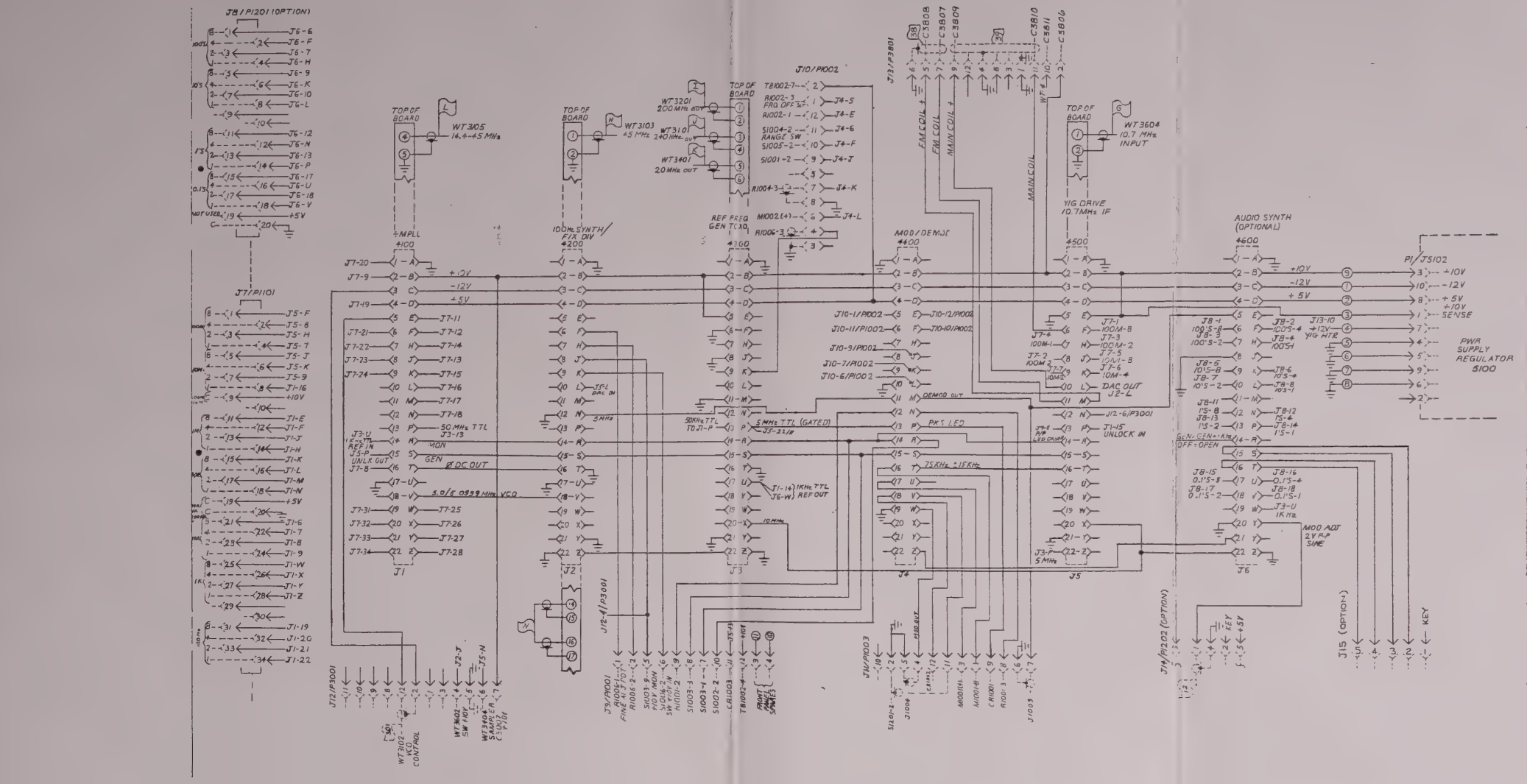


Figure 6-2. Main Interconnect Diagram

Table 6-2. Receive/Generate Switch Assembly (1300), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. PART NO.
1300	PCB ASSY-RCV/GEN SW MTG	7001-8802	Cushman	CE-4000
	DIODE			
CR1	DIO-1N4002 SI RECT A23F 100PRV 1A	1281-0023	ITT	1N4002
CR2	DIO-1N3864 SI SW D07/D035 75PRV 0.25W	1281-0013	Fairchild	1N3064
	RESISTOR			
R1	RES-22 OHM 5% 1/4W CC	1066-2205	A. Bradley	CB2205
	SWITCH			
S1	SW-TOGGLE SPDT	1850-0008	C&K Comps.	7101
	RELAY			
K1	RLY-DPDT 9VOC COIL 2C 1A PCM Mount	1313-0033	Aromat	DS2E-M-DC9N

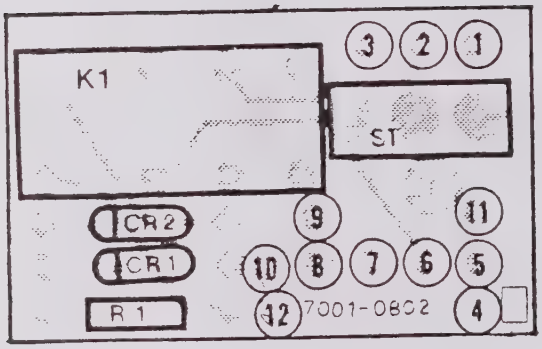


Figure 6-3. Receive/Generate Switch Assembly (1300), Component Location.

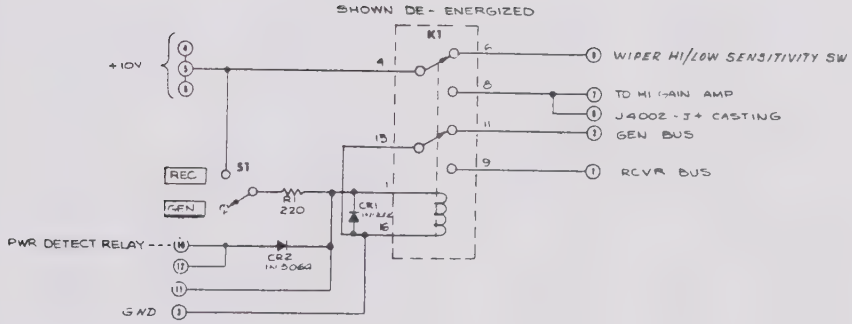


Figure 6-4. Receive/Generate Switch Assembly (1300) Schematic Diagram.

Table 6-3. Attenuator Assembly (2100), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
2100	PCB Assy - Attenuator	7001-0647	Cushman	CE-4000
	Printed Circuit Board	1780-1107	Cushman	
	CAPACITOR			
C1	CAP-0.1UF 20% 50V MINTR	1005-0097	Erie	81210506511
C2	CAP-0.1UF 20% 50V MINTR	1005-0097	Erie	81210506511
C3	CAP-0.1UF 20% 50V MINTR	1005-0097	Erie	81210506511
	DIODE			
CR1	DIO-IN3062 SI SW D07 1PF 75PRV	1281-0080	ITT	1N3062
CR2	DIO-1N3062 SI SW D07 1PF 75PRV	1281-0080	ITT	1N3062
CR3	DIO-1N3062 SI SW D07	1281-0080	ITT	1N3062
	RESISTOR			
R1	RES-60.4 OHM 1% 100PPM Film	1074-0115	CAT.LIST	55-100
R2	RES-240 OHM 1% 100PPM Film	1074-0098	CAT.LIST	55-100
R3	RES-60.4 OHM 1% 100PPM Film	1074-0115	CAT.LIST	55-100
R4	RES-60.4 OHM 1% 100PPM Film	1074-0115	CAT.LIST	55-100
R5	RES-249 OHM 1% 100PPM Film	1074-0098	CAT.LIST	55-100
R6	RES-60.4 OHM 1% 100PPM Film	1074-0115	CAT.LIST	55-100
R7	RES-60.4 OHM 1% 100PPM Film	1074-0115	CAT.LIST	55-100
R8	RES-249 OHM 1% 100PPM Film	1074-0098	CAT.LIST	55-100
R9	RES-60.4 OHM 1% 100PPM Film	1074-0115	CAT.LIST	55-100
R10	RES-60.4 OHM 1% 100PPM Film	1074-0115	CAT.LIST	55-100
R11	RES-249 OHM 1% 100PPM Film	1074-0098	CAT.LIST	55-100
R12	RES-60.4 OHM 1% 100PPM Film	1074-0098	CAT.LIST	55-100

Table 6-3. Attenuator Assembly (2100), Parts List. (Concluded)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	SWITCHES			
S1	SW-SPDT 10.1A 125/250 VAC PCB MT MICRO	1850-0039	Cherry	C/EDWG (E6289KW/PC)
S2	SW-SPDT 10.1A 125/250 VAC PCB MT MICRO	1850-0039	Cherry	C/EDWG (E6289KW/PC)
S3	SW-SPDT 10.1A 125/250 VAC PCB MT MICRO	1850-0039	Cherry	C/EDWG (E6289KW/PC)
S4	SW-SPDT 10.1A 125/250 VAC PCB MT MICRO	1850-0039	Cherry	C/EDWG (E6289KW/PC)
S5	SW-SPDT 10.1A 125/250 VAC PCB MT MICRO	1850-0039	Cherry	C/EDWG (E6289KW/PC)
S6	SW-SPDT 10.1A 125-250 VAC PCB MT MICRO	1850-0039	Cherry	C/EDWG (E6289KW/PC)
S7	SW-SPDT 10.1A 125-250 VAC PCB MT MICRO	1850-0039	Cherry	C/EDWG (E6289KW/PC)
S8	SW-SPDT 10.1A 125-250 VAC PCB MT MICRO	1850-0039	Cherry	C/EDWG (E6289KW/PC)

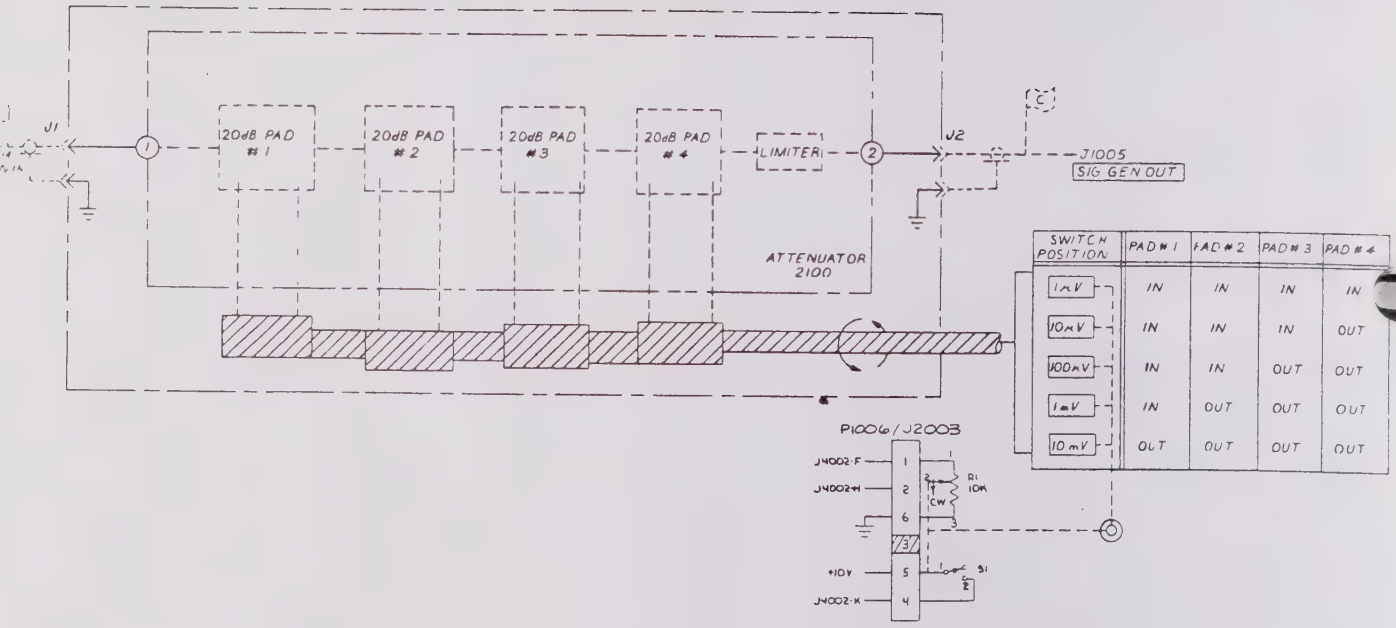


Figure 6-5. Interconnect Diagram Attenuator Assembly.

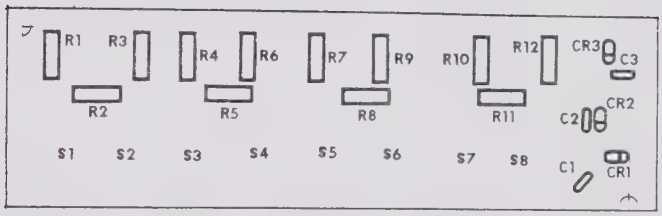


Figure 6-6. Attenuator Assembly (2100), Component Location

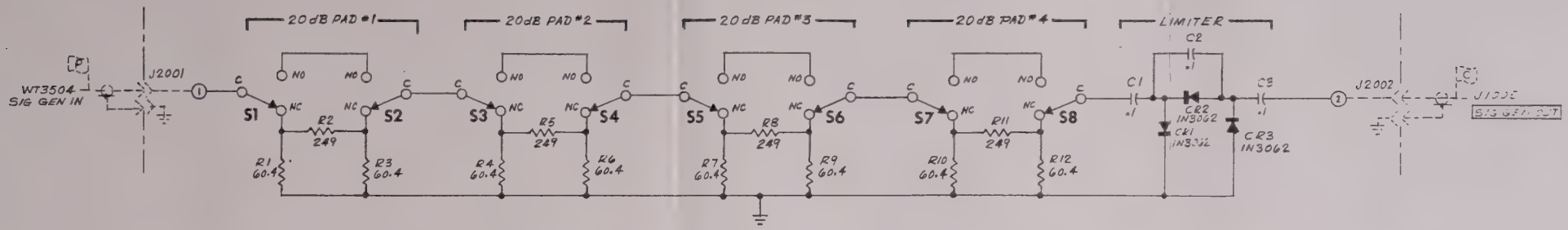


Figure 6-7. Attenuator Assembly (2100) Schematic Diagram.

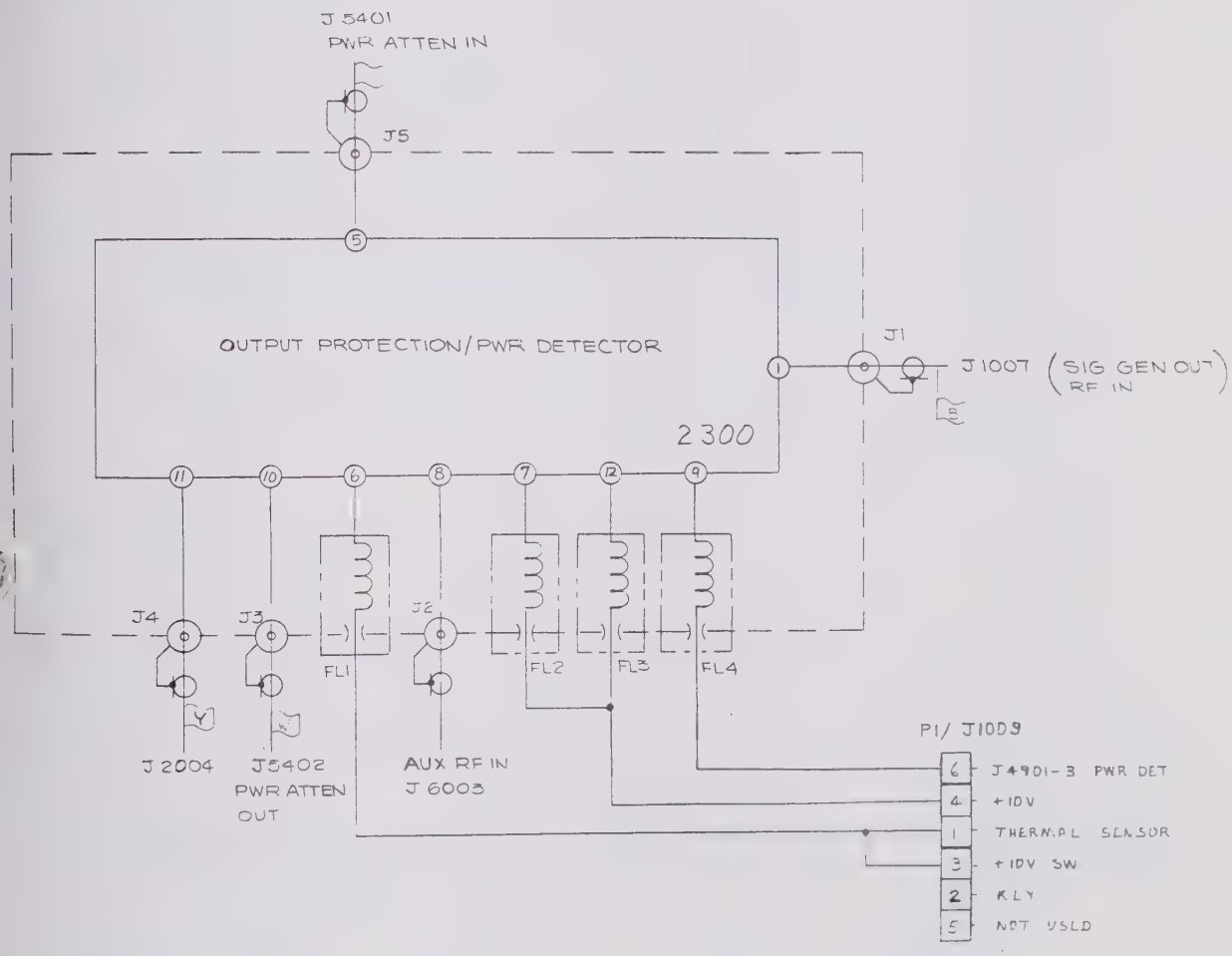


Figure 6-8. Interconnect Diagram RF Output Casting.

Table 6-4 Output Protect/Power Detect Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. PART NO.
2300	PCB ASSY-OUTPUT PROT/PWR DET	7001-0799		
	CAPACITOR			
C1	CAP-0.082 UF 20% 100V BX CHIP	1012-0041	Viclan	1812B823M3P
C2	CAP-0.082 UF 20% 100V BX CHIP	1012-0041	Viclan	1812B823M3P
C3	Not Used			
C4	CAP-1PF 0.5PF 50V NPO CHIP	1012-0019	Vitramon	VJ0805A1R00H
C5	CAP-6.8PF 0.5PF 50V NPO CHIP	1012-0012	Varidyne	30BN05056R8DS
C6	CAP-0.082 F 20% 100V BX CHIP	1012-0041	Viclan	1812B823M3P
C7	Not Used			
C8	CAP-100PF 10% 50V NPO NPO CHIP	1012-0004	Novacap	0805N101K500A
C9	CAP-0.082 UF 20% 100V BX CHIP	1012-0041	Viclan	1812B823M3P
C10	CAP-10UF 20% 35V RDL TANT	1011-0006	Matsud	22L3502106M3
C11	CAP-0.082 UF 20% 100V BX CHIP	1012-0041	Viclan	1812B823M3P
C12	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C13	CAP-150PF 10% 100V NP MINTR CER	1005-0108	Erie	8121100C0G0 151K
C14	CAP-0.1UF 20% 50V MIN MINTR CER RED	1005-0097	Erie	8121050651 104M
C15	CAP-2.7PF 0.25PF 50V NPO CHIP	1012-0032	NorCalAssoc	3BP050S2R7C3
C16	CAP-10UF 20% 35V RDL ELCTLT	1013-0044	Nichicon	35UKB10M
C17	CAP-1.5PF 0.25PF 100V NPO MINTR	1005-0121	Centre Engr	10010NP0159C

Table 6-4 Output Protect/Power Detect Parts List(Continued)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	DIODE			
CR1	DIO-1N3062 SI SW DO7 1PF 75PRV	1281-0080	ITT	1N3062
CR2	DIO-1N3062 SI SW DO7 1PF 75PRV	1281-0080	ITT	1N3062
CR3	DIO-HP2826 HOT CARR 1.2PF A1N 15PRV BM	1283-0005	HP	5082-2826
CR4	DIO-HP2826 HOT CARR 1.2PF A1N 15PRV BM	1283-0005	HP	5082-2826
CR5	DIO-1N4002 SI RECT A2 A32F 100PRV 1A	1281-0023	ITT	1N4002
CR6	DIO-1N5167 SI SW A1AC 29V 0.0125V	1281-0169	Aertech	A25303
CR7	DIO-1N5167 SI SW A1AC 20V 0.0125V	1281-0169	Aertech	A25303
CR8	Not Used			
CR9	DIO-1N5167 SI SW A1AC 20V 0.0125V	1281-0169	Aertech	A25303
CR10	DIO-1N4739A SI ZENER A98A 9.1V 5% 1W	1281-0027	IRC	1N4739A
	RELAY			
K1	RLY-DPDT 12VDC COIL 2A CONT PCB MT	1313-0038	HI-G	2K-2A-112
	INDUCTOR			
L1	Not Used			
L2	Not Used			
L3	Not Used			
L4	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
	TRANSISTOR			
Q1	XSTR-VN0104 SI TO 92 MOSFET N-CHAN	1272-0132	Supertex Inc	VN0104N3
	RESISTOR			
R1	Not Used			
R2	Not Used			
R3	RES-1MEG 5% 1/8W CC	1065-1055	A. Bradley	BB1055
R4	RES-150K 5% 1/8W CC	1065-1545	A. Bradley	BB1545

Table 6-4 Output Protect/Power Detect Parts List(Concluded)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R5	POT-500 OHM 10% 1/2W 1T CERMET TRMR	1215-0051	A. Bradley	A2A501
R6	Not Used			
R7	RES-82 OHM 5% 1/8W CC	1065-8205	A. Bradley	BB8205
R8	Not Used			
R9	RES-3.9K 5% 1/8W CC	1065-3925	A. Bradley	BB3925
R10	Not Used			
R11	RES-20K 5% 1/8W CC	1065-2035	A. Bradley	BB2035
R12	RES-6.2K 5% 1/8W CC	1065-6225	A. Bradley	BB6225
R13	RES-100K 5% 1/8W CC	1065-1045	A. Bradley	BB1045
R14	Not Used			
R15	RES-20K 5% 1/8W CC	1065-2035	A. Bradley	BB2035
R16	RES-51 OHM 5% 18W CC	1065-5105	A. Bradley	BB5105
R17	RES-180 OHM 5% 1/8W CC	1065-1815	A. Bradley	BB1815
R18	RES-30 OHM 5% 1/8W CC	1065-3005	A. Bradley	BB3005
R19	RES-39 OHM 5% 1/8W CC	1065-3905	A. Bradley	BB3905
R20	RES-30K 5% 1/8W CC	1065-3035	A. Bradley	BB3035
R21	RES-1K 5% 1/8W CC	1065-1025	A. Bradley	BB1025
	INTEGRATED CIRCUIT			
U1	IC-CA3130T OP AMPL	2025-0161	RCA	CA3130T
U2	IC-3130 8 PIN DIP OP AMPL	2025-0269	RCA	CA3130E

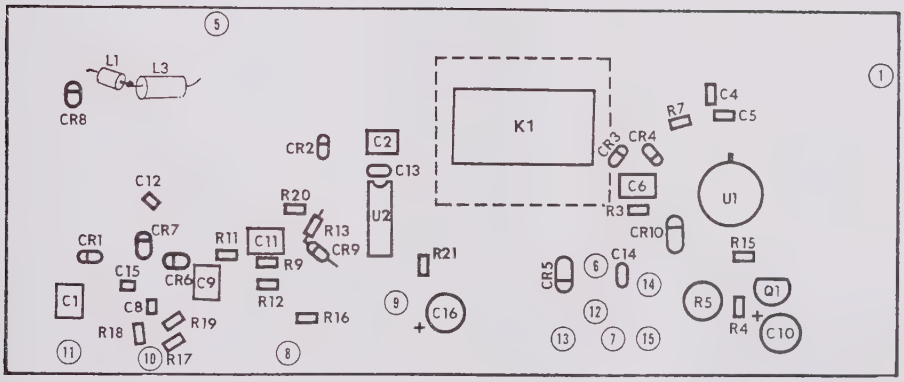


Figure 6-9. Output Protect/Power Detect (2300) Component Location.

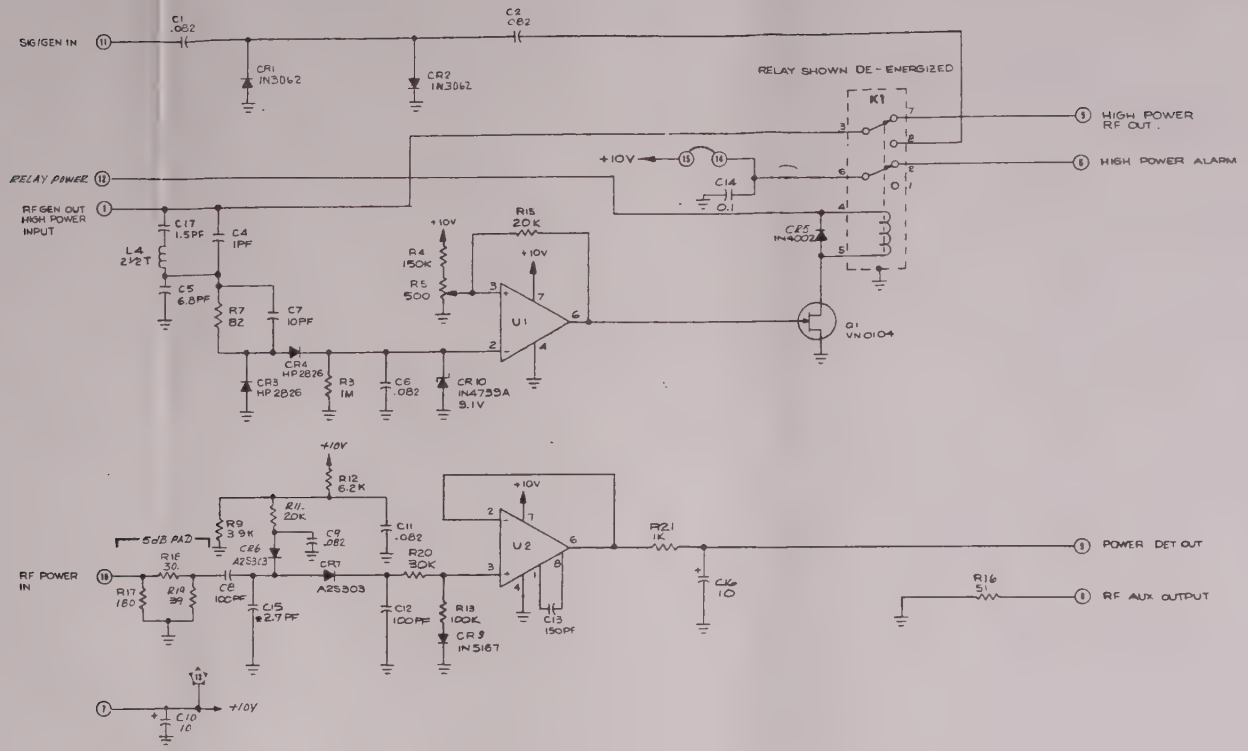


Figure 6-10. Power Detect/Protect (2300) Schematic Diagram.

Table 6-5 Output Level CAL Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR NO.
2400	PCB ASSY-OUTPUT LEVEL CAL	7001-8804	Cushman	CE-4000
	CAPACITOR			
C1	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C2	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C3	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C4	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C5	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C6	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C7	CAP-56PF 10% 100V NPO MINTR CER	1005-0109	Tusonix	8121100C0G0 560K
	DIODE			
CR1	DIO-1N3064 SI SW DO7/ DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR2	DIO-1N3064 SI SW DO7/ DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR3	DIO-1N3064 SI SW DO7/ DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR4	DIO-1N3064 SI SW DO7/ DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR5	DIO-1N3064 SI SW DO7/ DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR6	DIO-1N3064 SI SW DO7/ DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR7	DIO-1N3064 SI SW DO7/ DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR8	DIO-1N3064 SI SW DO7/ DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR9	DIO-1N3064 SI SW DO7/ DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR10	DIO-1N3064 SI SW DO7/ DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR11	DIO-1N3064 SI SW DO7/ DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR12	DIO-1N3064 SI SW DO7/ DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064

Table 6-5 Output Level CAL Parts List (Continued)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR NO.
	CONNECTOR			
J1	CONN-8 PIN 0.1SP STR UCG PCB MT JK	2535-0141	Methode	1100810801
	RESISTOR			
R1	Not Used			
R2	RES-26.1K 1% 100PPM FILM	1075-0182	Shelly Rodabaugh	RN550
R3	RES-47.5K 1% 100PPM FILM	1075-0076	CAT.LIST	55-100
R4	RES-23.2K 1% 150PPM FILM	1074-1006	CAT.LIST	55-100
R5	POT-10K 20% 1/2W 1T CERMET TRMR	1215-0043	Beckman	91AR10K
R6	RES-33.3K 1% 100PPM FILM	1075-0072	CAT.LIST	55-100
R7	RES-23.2K 1% 150PPM FILM	1074-1006	CAT.LIST	55-100
R8	POT-10K 20% 1/2W 1T CERMET TRMR	1215-0043	Beckman	91AR10K
R9	RES-33.3K 1% 100PPM FILM	1075-0072	CAT.LIST	55-100
R10	RES-23.2K 1% 150PPM FILM	1074-1006	CAT.LIST	55-100
R11	POT-10K 20% 1/2W 1T CERMET TRMR	1215-0043	Beckman	91AR10K
R12	RES-33.3K 1% 100PPM FILM	1075-0072	CAT.LIST	55-100
R13	RES-23.2K 1% 150PPM FILM	1074-1006	CAT.LIST	55-100
R14	POT-10K 20% 1/2W 1T CERMET TRMR	1215-0043	Beckman	91AR10K
R15	RES-33.3K 1% 100PPM FILM	1075-0072	CAT.LIST	55-100
R16	POT-50K 10% CERMET TRMR	1215-0023	Beckman	89WR
R17	POT-50K 10% CERMET TRMR	1215-0023	Beckman	89WR
R18	POT-50K 10% CERMET TRMR	1215-0023	Beckman	89WR
R19	POT-50K 10% CERMET TRMR	1215-0023	Beckman	89WR
R20	POT-50K 10% CERMET TRMR	1215-0023	Beckman	89WR

Table 6-5 Output Level CAL Parts List (Concluded)

REF. NO.	DESCRIPTION	CE STOCK	MANUFACTURER	MFR. NO.
R21	RES-1.2MEG 5% 1/4W CC	1066-1255	A. Bradley	BB1255
R22	RES-820K 5% 1/4W CC	1066-8245	A. Bradley	BB8245
R23	RES-510K 5% 1/4W CC	1066-5145	A. Bradley	BB5145
R24	RES-1MEG 5% 1/4W CC	1066-1855	A. Bradley	BB1855
R25	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	BB2015
	INTEGRATED CIRCUIT			
U1	IC-4028B 16 PIN DIP BCD-TO-DEC DCDR	2025-0195	Motorola	MC14028BP
U2	IC-LM308N OP AMPL 8 PIN	2025-0070	National	LM308N

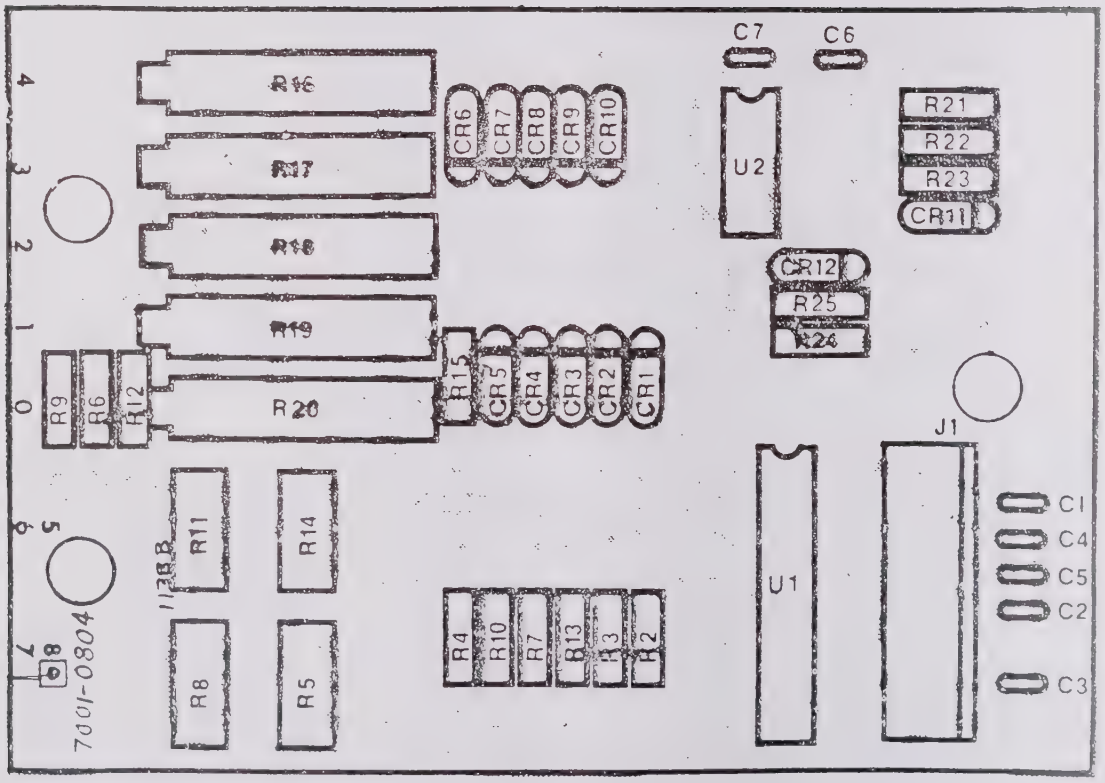


Figure 6-11. Output Level CAL (2400) Component Location.

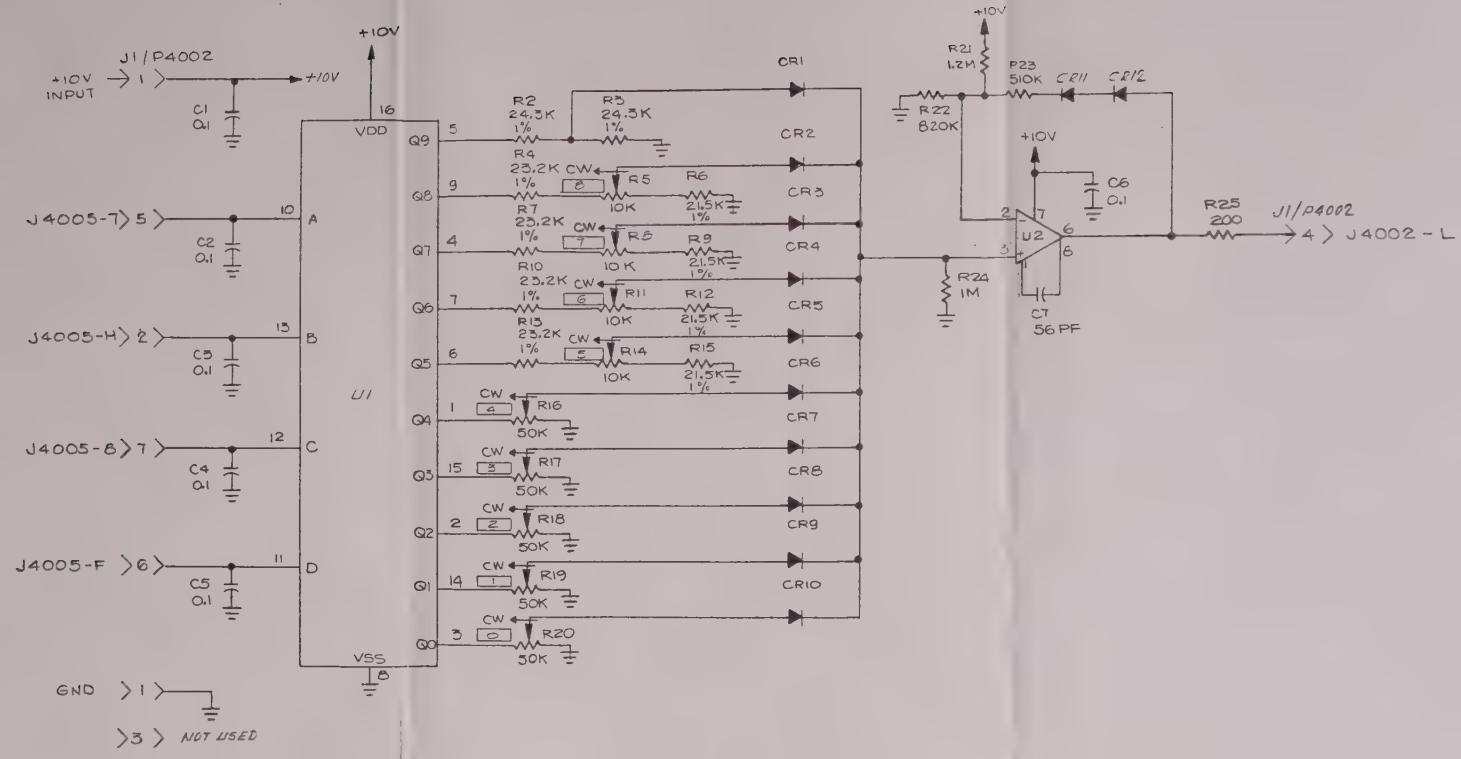


Figure 6-12. Output Level CAL (2400) Schematic Diagram.

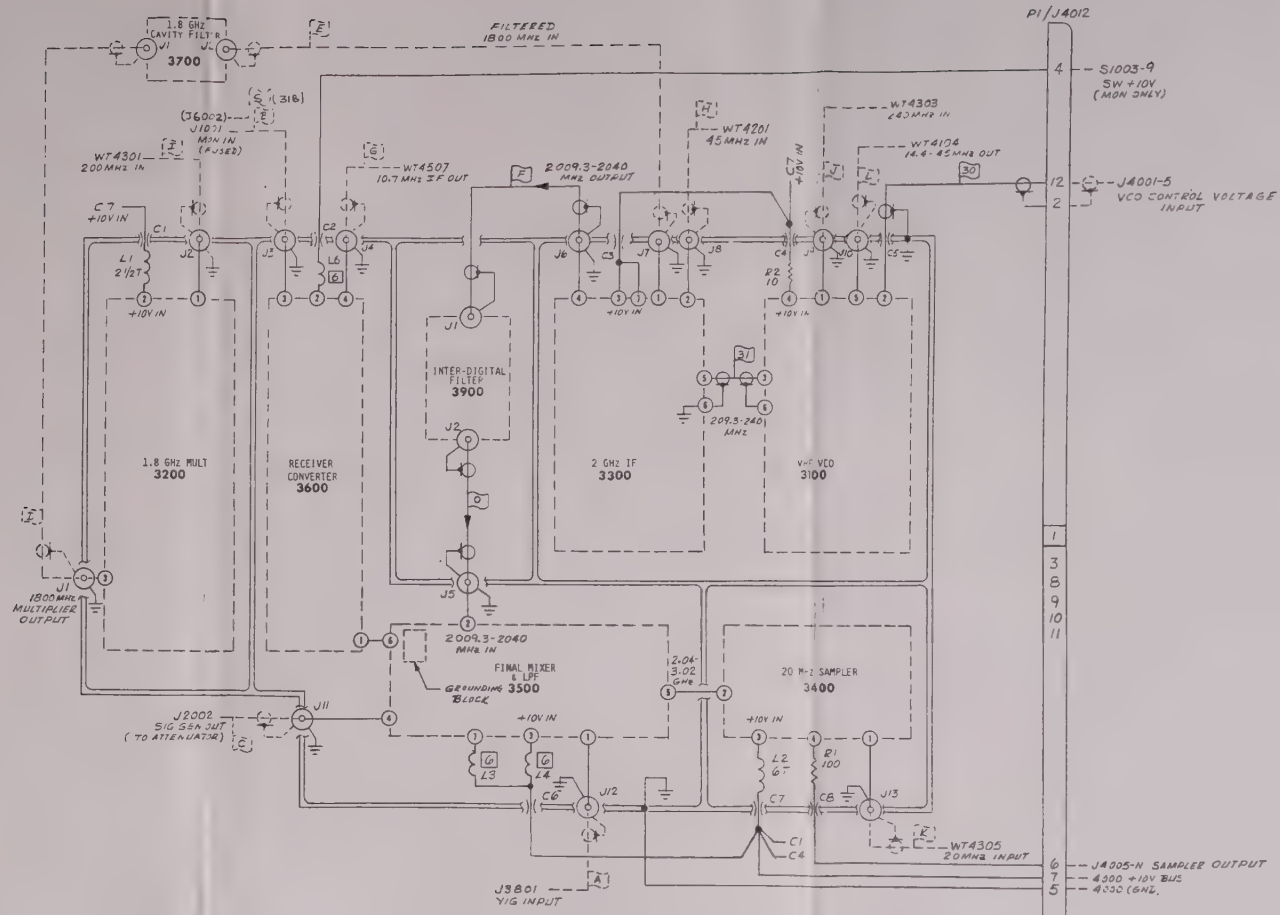


Figure 6-13. Microwave Casting Interconnect Diagram.

Table 6-6. VHF VCO (3100), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
3100	PCB Assy - VHF/VCO	7001-0641	Cushman	CE-4000
	CAPICATOR			
C1	CAP-0.01UF +80-20% Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C2	CAP-0.01UF +80-20% Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C3	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100XY7RO 221K
C4	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100XY7RO 221K
C5	CAP-1.5PF 0.25PF 100V NPO MINTR CER	1005-0121	Centre Engr	100100NP0159C
C6	CAP-820PF 10% 1KV Z5R CER DISC	1005-0047	Centralab	DD821
C7	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C8	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7RO 221K
C9	CAP-15PF 10% 100V NPO MINTR CER	1005-0123	Tusonix	8111100C0G0 150K
C10	CAP-2.7PF 10% 100V NPO MINTR CER	1005-0124	Tusonix	8101100C0J0 279C
C11	CAP-5.6PF 10% 100V NPO MINTR CER	1005-0111	Tusonix	8101100C0G0 569D
C12	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7RO 221K
C13	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100XYRO 221K
C14	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100XYRO 221K
C15	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C16	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C17	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C18	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
	DIODE			
CR1	DIO-MV104 SI DUAL VARICAP TO92 40PF 32	1281-0058	Motorola	MV104

Table 6-6. VHF VCO (3100), Parts List (Continued)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	INDUCTOR			
L1	CH-3B FERRITE BEAD 30GA/6T	1586-0007		
L2	COIL-AIR CORE CT 0.128 DIA/20GA/3T	1596-0310	Cushman	C/E DWG & M/L
L3	CH-15UH 10% RF MLD AXL 0.16X0.38L	1585-0034	Delevan	1537-40
L4	CH-3.9UH 10% RF MLD 0.16DX0.38L	1585-0014	Delevan	1537-26
	TRANSISTOR			
Q1	XSTR-MPSH81 PNP SI TO92 LOW PWR	1272-0111	Motorola	MPSH81
Q2	XSTR-NE73432E NPN SI TO92 LOW PWR	1272-0112	Cailf Eastern Labs	6EM8Z
Q3	SXTR-40673 SI TO72 FET N-CHAN	1272-0128	RCA	40673
Q4	SXTR-2N5179 NPN SI TO72 LOW PWR (MOTA)	1272-0060	Motorola	2N5179
	RESISTOR			
R1	RES-2.7K 5% 1/4W CC	1066-2725	A. Bradley	CB2725
R2	RES-2.7K 5% 1/4W CC	1066-2725	A. Bradley	CB2725
R3	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R4	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R5	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R6	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R7	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R8	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R9	RES-39 OHM 5% 1/4W CC	1066-3905	A. Bradley	CB3905
R10	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R11	RES-39 OHM 5% 1/8W CC	1065-3905	A. Bradley	BB3905
R12	RES-1.5K 5% 1/4W CC	1066-1525	A. Bradley	CB1525
R13	RES-390 OHM 5% 1/4W CC	1066-3915	A. Bradley	CB3915
R14	RES-560 OHM 5% 1/4W CC	1066-5615	A. Bradley	CB5615
R15	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R16	RES-51 OHM 5% 1/4W CC	1066-5105	A. Bradley	CB5105
R17	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R18	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R19	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R20	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725

Table 6-6. VHF VCO (3100), Parts List(Concluded)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	RESISTOR			
R21	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R22	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R23	RES-1.5K 5% 1/4W CC	1066-1525	A. Bradley	CB1525
	TRANSISTOR			
T1	XFMR-TOROIDAL 2/36GA/4T	1579-0050		

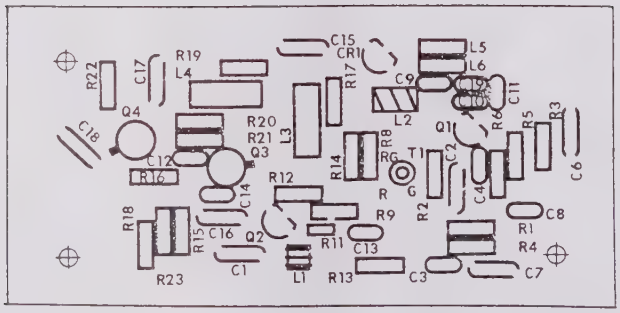


Figure 6-14. VHF VCO (3100) Component Location.

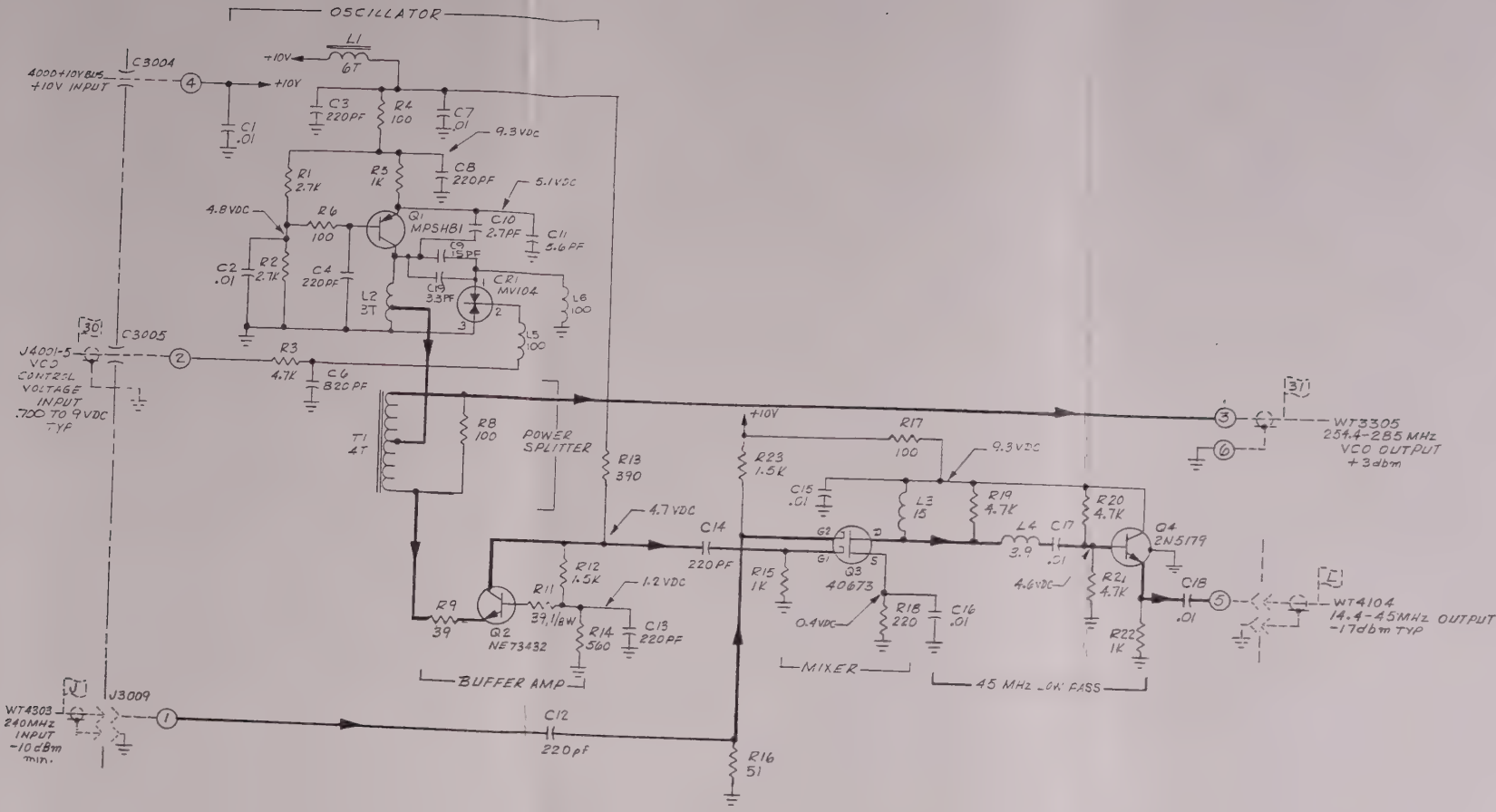


Figure 6-15. VHF VCO (3100) Schematic Diagram.

Table 6-7. 1.8 GHz Multiplier (3200), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
3200	PCB ASSY - 1.8 GHZ MULTIPLIER	7001-0642	Cushman	CE-4000
	PRINTED CIRCUIT BOARD	1780-1108	Cushman	
	CAPACITOR			
C1	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651103M
C2	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651103M
C3	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651103M
C4	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7R0 221K
C5	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011A2-8
C6	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651103M
C7	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651103M
C8	CAP-56PF 10% 100V NPO MINTR CER	1005-0109	Tusonix	8121100C0G0 560K
C9	CAP-15PF 5% 500V NPO CER TUB	1005-0010	Tusonix	301000C0G0150J
C10	CAP-5.5-18PF 350V NPO V MT CER TRMR	1001-0008	Erie	CV31A180
C11	CAP-33PF 10% 50V NPO CHIP	1012-0025	Johanson	500R15N330KA
C12	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011A2-8
C13	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7R0 221K
C14	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7R0 221K
C15	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7R0 221K
C16	CAP-10UF +100-10% 25V	1013-0035	Illinois Cap	10PC25
	DIODE			
CR1	DIO-HP0112 SI STEP RCVY DO7 1.55PF 35V	1282-0018		

Table 6-7. 1.8 GHz Multiplier (3200), Parts List (Concluded)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	INDUCTOR			
L1	CH-2.7UH 10% RF MLD AXL 0.16DX0.38L	1585-0049	Delevan	1537-22
L2	CH-0.12UH 10% RF MLD AXL 0.10DX0.25L	1585-0068	Delevan	1025-96
L3	CH-2.7UH 10% RF MLD AXL 0.16DX0.38L	1585-0049	Delevan	1537-22
L4	CH-0.1UH 10% RF MLD SHLD AXL 0.16DX0.40L	1585-0041	Delevan	1641-101
L5	CH-2.7UH 10% RF MLD AXL 0.16DX0.38L	1585-0049	Delevan	1537-22
L6	ASSY-COIL-AIR-CORE	1596-0071	Delevan	
L7	ASSY-COIL-AIR-CORE	1596-0068	Delevan	
			Delevan	
	TRANSISTOR			
Q1	XSTR-2N5179 NPN SI TO72 LOW PWR (MOTA)	1272-0060	Motorola	2N5179
Q2	XSTR-2N5109 NPN SIk TO39 HIGH PWR	1272-0110	Motorola	2N5109
	RESISTOR			
R1	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R2	RES-2K 5% 1/4W CC	1066-1225	A. Bradley	CB1225
R3	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R4	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R5	RES-750 OHM 5% 1/4W CC	1066-7515	A. Bradley	CB7515
R6	RES-51 OHM 5% 1/4W CC	1066-5105	A. Bradley	CB5105
R7	RES-5.6 OHM 5% 1/4W CC	1066-0003	A. Bradley	CB56G5
R8	RES-18 OHM 5% 1/4W CC	1066-1805	A. Bradley	CB1805
R9	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R10	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R11	RES-1.5K1 5% 1/4W CC	1066-1525	A. Bradley	CB1525
R12	RES-10 OHM 5% 1/8 CC	1065-1005	A. Bradley	BB1005
R13	RES-820 OHM 5% 1/8 CC	1065-8215	A. Bradley	BB8215
R14	RES-820 OHM 5% 1/8 CC	1065-8215	A. Bradley	BB8215
R15	RES-750 OHM 5% 1/4W CC	1066-7515	A. Bradley	CB7515

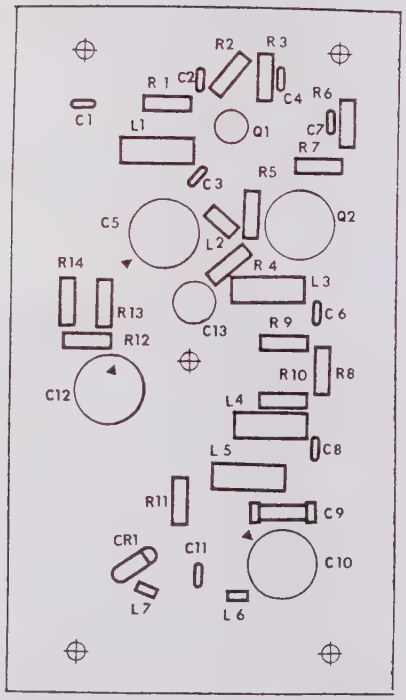


Figure 6-16. 1.8 GHz Multiplier (3200) Component Location.

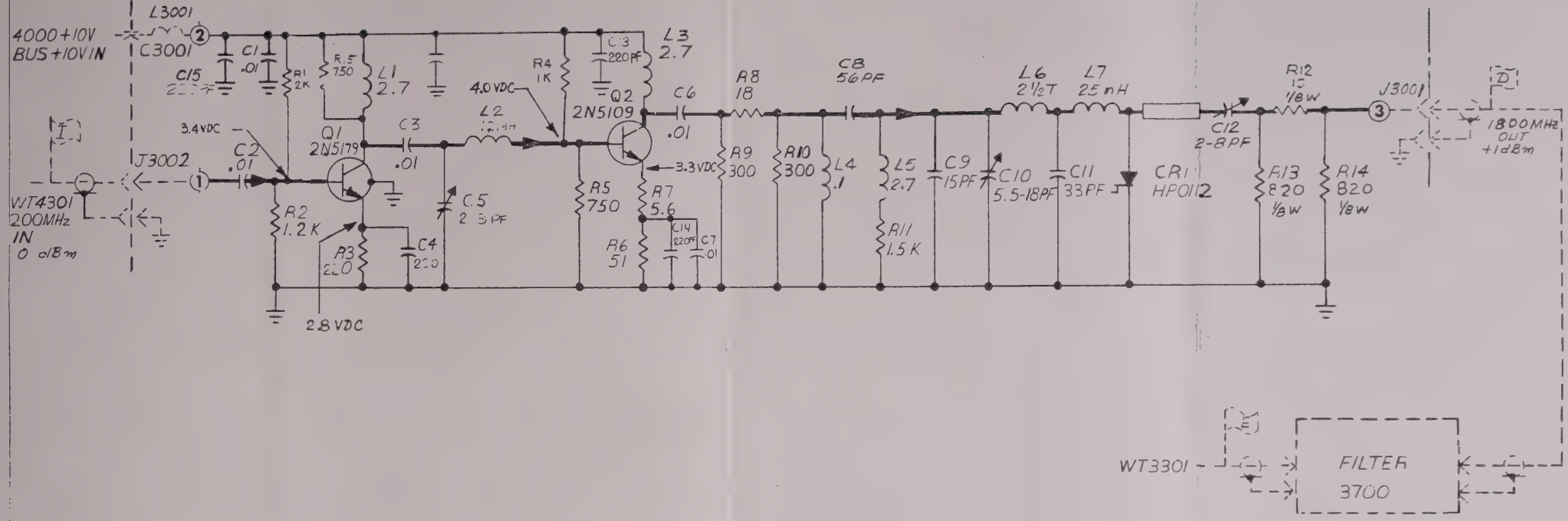


Figure 6-17. 1.8 GHz Multiplier (3200) Schematic Diagram.

Table 6-8. 2 GHz IF (3300), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
3300	PCB ASSY - 2 GHZ IF PRINTED CIRCUIT BOARD	7001-0643 1780-1121	Cushman Cushman	CE-4000
	MIXER			
BM1	MXR-SBL-1 DBL BAL 1-500MHz	2010-0009	Mini Circuits Lab	SBL-1
	CAPACITOR			
C1	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7R0 221K
C2	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C3	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7R0 221K
C4	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7R0 221K
C5	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7R0 221K
C6	CAP-75PF 5% 500V DIP MICA	1002-0025	Elmenco	DM15E750J
C7	CAP-12PF 5% 500V DIP MICA	1002-0017	Elmenco	DM15C120J
C8	CAP-5.5-18PF 350V NPO V MT CER TRMR	1001-0008	Erie	CV31A180
C9	CAP-5.5-18PF 350V NPO V MT CER TRMR	1001-0008	Erie	CV31A180
C10	CAP-20PF 5% 500V DIP MICA	1002-0060	Elmenco	DM15E200J
C11	CAP-20PF 5% 500V DIO MICA	1002-0060	Elmenco	DM15E200J
C12	CAP-5.5-18PF 350V NPO V MT CER TRMR	1001-0008	Erie	CV31A180
C13	CAP-15PF 5% 500V DIP MICA	1002-0001	Elmenco	DM15C150J
C14	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7R0 221K
C15	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C16	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C17	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7R0 221K

Table 6-8. 2 GHz IF (3300), Parts List (Continued)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C18	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7R0 221K
C19	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novcap	0805N101K500A
C20	CAP-.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651103M
C21	CAP-1.5PF .25PF 50V NPO CHIP	1012-0002	Viclan	0805NP01R5C 50PS
C22	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C23	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C24	CAP-2.7PF .25PF 50V NPO CHIP	1012-0032	Norcal Assoc	3BP050S2R7C S
C25	CAP-1.5PF .25PF 50V NPO CHIP	1012-0002	Viclan	0805NP01R5C 50PS
C26	CAP-1.5PF .25PF 50V NPO CHIP	1012-0002	Viclan	0805NP01R5C 50PS
C27	CAP-1.5PF .25PF 50V NPO CHIP	1012-0002	Viclan	0805NP01R5C 50PS
C28	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C29	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C30	CAP-5.5-18PF 350V NPO V MT CER TRMR	1001-0008	Erie	CV31A180
	DIODE			
CR1	DIP-HP2826 HOT CARR 1.2PF A1N 15PRV BM	1283-0005	HP	5082-2826
CR2	DIP-HP2826 HOT CARR 1.2PF A1N 15PRV BM	1283-0005	HP	5082-2826
	INDUCTOR			
L1	CH-0.15UH 10% RF MLD AXL .10DX.25L	1585-0065	Delevan	1025/00
L2	CH-0.22UH 20% RF MLD AXL .16DX.38L	1585-0039	Delevan	1537-02
L3	COIL-AIR CORE .172 DIA/18GA/5T	1596-0276		
L4	COIL-AIR CORE .172 DIA/18GA/5T	1596-0276		

Table 6-8. 2 GHz IF (3300), Parts List (Continued)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
L5	COIL-AIR CORE .172 DIA/18GA/5T	1596-0276		
L6	CH-.15UH 20% RF MLD AXL .16DX.38L	1585-0048	Delevan	1537-00
L7	ASSY-COIL .047 UH RF	1596-5801		
L8	ASSY-COIL-AIR CORE	1596-0068		
	TRANSISTOR			
Q1	XSTR-NE73432E NPN S1 TO92 LOW PWR	1272-0112	Calif Eastern Labs	6EM8Z
Q2	XSTR-NE73432E NPN S1 TO92 LOW PWR	1272-0112	Calif Eastern Labs	6EM8Z
Q3	XSTR-NE73432E NPN S1 TO92 LOW PWR	1272-0112	Calif Eastern Labs	6EM8Z
Q4	XSTR-NE73432E NPN S1 TO92 LOW PWR	1272-0112	Calif Eastern Labs	6EM8Z
Q5	XSTR-NE57835 NPN SI LOW PWR	1262-0086	Nippon Elec	NE57835
Q6	XSTR-NE57835 NPN SI LOW PWR	1272-0086	Nippon Elec	NE57835
	RESISTOR			
R1	RES-43 OHM 5% 1/8W CC	1065-4305	A. Bradley	BB4305
R2	RES-560 OHM 5% 1/4W CC	1066-5615	A. Bradley	CB5615
R3	RES-39 OHM 5% 1/8W CC	1065-3905	A. Bradley	BB3905
R4	RES-47 OHM 5% 1/8W CC	1066-4705	A. Bradley	CB4705
R5	RES-390 OHM 5% 1/4W CC	1066-3915	A. Bradley	CB3915
R6	RES-39 OHM 5% 1/4W CC	1066-3905	A. Bradley	CB3905
R7	RES-1.5K 5% 1/4W CC	1066-1525	A. Bradley	CB1525
R8	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R9	RES-22 OHM 5% 1/8W CC	1065-2205		
R10	RES-22 OHM 5% 1/4W CC	1066-2205	A. Bradley	CB2205
R11	RES-39 OHM 5% 1/4W CC	1066-3905	A. Bradley	CB3905
R12	RES-560 OHM 5% 1/4W CC	1066-5615	A. Bradley	CB5615
R13	RES-1.5K 5% 1/4W CC	1066-1525	A. Bradley	CB1525
R14	RES-330 OHM 5% 1/4W CC	1066-3315	A. Bradley	CB3315
R15	RES-39 OHM 5% 1/4W CC	1066-3905	A. Bradley	CB3905
R16	RES-39 OHMk 5% 1/4W CC	1066-3905	A. Bradley	CB3905
R17	RES-430 OHM 5% 1/4W CC	1066-4315	A. Bradley	CB4315
R18	RES-39 OHM 5% 1/4W CC	1066-3905	A. Bradley	CB3905
R19	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R20	RES-3.9K 5% 1/8W CC	1065-3925	A. Bradley	BB3925

Table 6-8. 2 GHz IF Assembly (3300), Parts List (Concluded)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R21	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R22	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R23	RES-3.9Kk 5% 1/4W CC	1066-3925	A. Bradley	CB3925
R24	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R25	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R26	RES-18 OHM 5% 1/8W CC	1065-1805	A. Bradley	CB1805
R27	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
	TRANSFORMER			
T1	XFMR-TOROIDIAL BIFILAR	1579-0042		

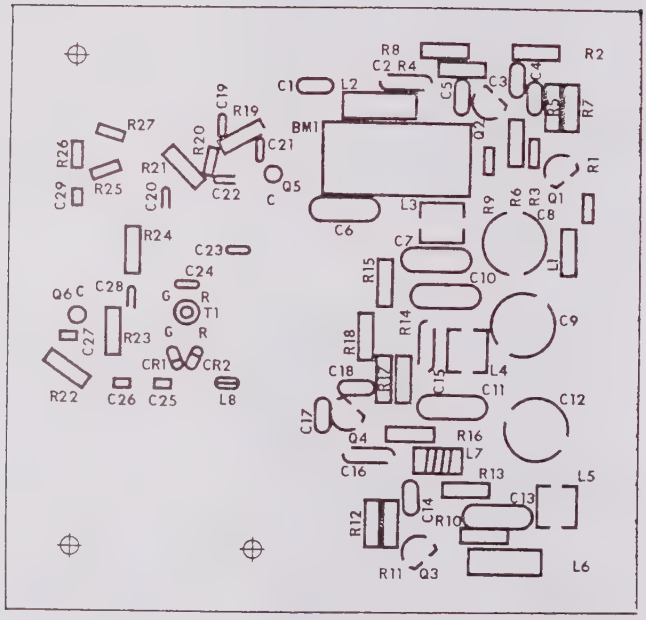


Figure 6-18. 2 GHz IF (3300) Component Location.

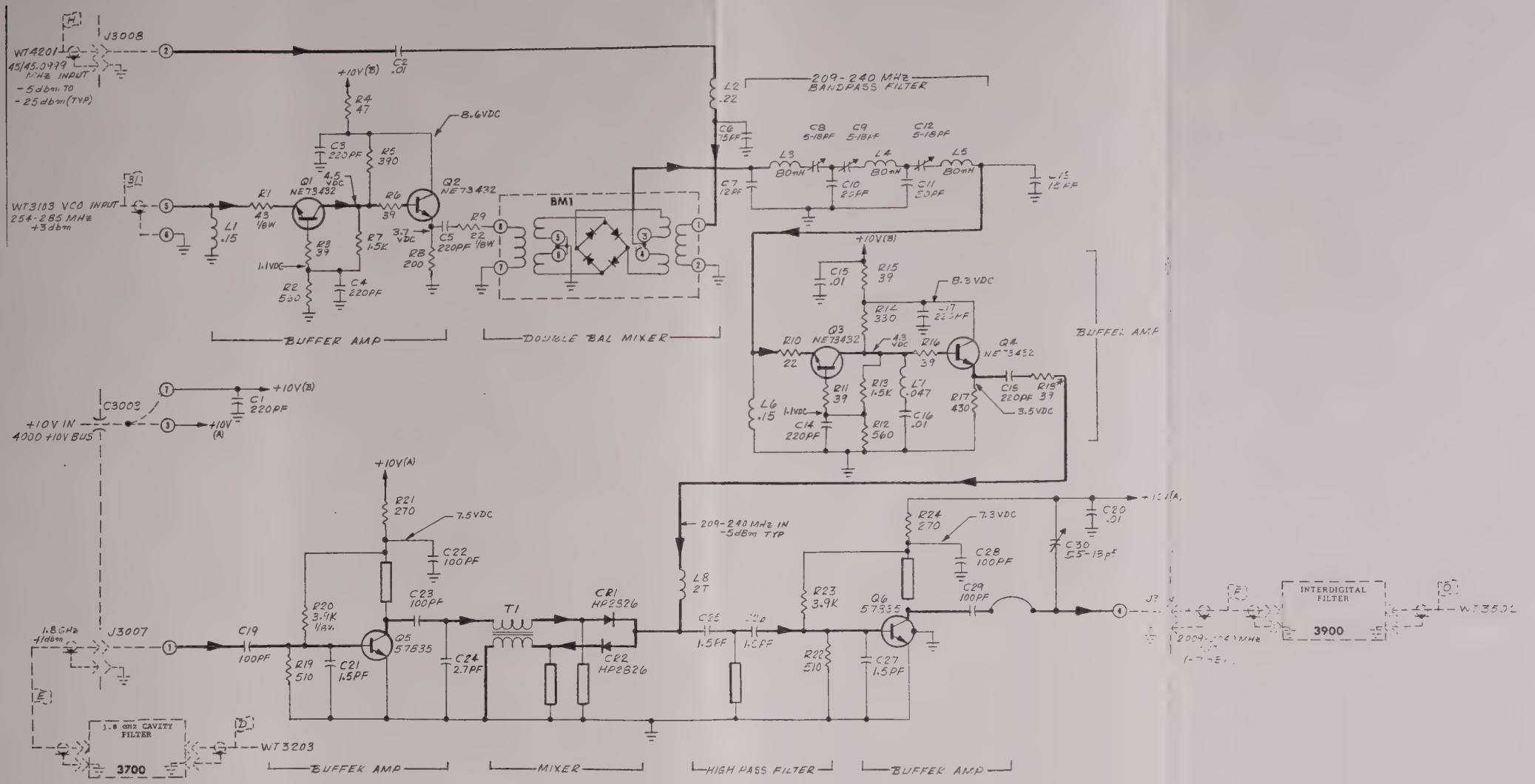


Figure 6-19. 2 GHz IF (3300) Schematic Diagram.

Table 6-9. 20 Mhz Sampler (3400), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
3400	PCB ASSY - 20 MHz Sampler	7001-0644	Cushman	CE-4000
	Printed Circuit Board	1780-1111	Cushman	
	CAPACITOR			
C1	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C2	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0012	Tusonix	5835512Y5U103Z
C3	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Panasonic	ECEA1HV010S
C4	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C5	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C6	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C7	CAP-910PF 5% 100V DIP MICA	1002-0062	Elmenco	DM15F911J
C8	CAP-2700PF 10% 50V NPO CHIP	1012-0036	Varayne	5BP050S272KS
C9	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U103Z
C10	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C11	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C12	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C13	CAP-8.2PF.5PF 50V NPO CHIP	1012-0030	Novacap	1005N8R2D500A
C14	CAP-8.2PF.5PF 50V NPO CHIP	1012-0030	Novacap	1005N8R2D500A
C15	CAP-0.5-2PF 250V-200PPM MINTR TRMR	1001-0023		
C16	CAP-1000PF 10% 100V W5R MINTR CER	1005-0081	Tusonix	811100X7R0120K
	DIODE			
CR1	DIP-HP0180 SI STEP RCVY D07 4.6PF 50V	1282-0008	HP	5082-0180
CR2	DIO-HP2826 HOT CARR 1.2PF AIN 15PRV1 BM	1283-0005	HP	5082-2826

Table 6-9. 20 MHz Sampler (3400), Parts List (Continued)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
CR3	DIO-HP2826 HOT CARR 1.2PF A1N 15PRV BM	1283-0005	HP	5082-2826
CR4	DIO-HP2826 HOT CARR 1.2PF A1N 15PRV BM	1283-0005	HP	5082-2826
CR5	DIO-HP2826 HOT CARR 1.2PF A1N 15PRV BM	1283-0005	HP	5082-2826
	INDUCTOR			
L1	CH-10UH 10% RF MLD AXL .16DX.38L	1585-0016	Delevan	1537-36
L2	CH-3B FERRITE BEAD 30GA/6T	1586-0007		
L3	COIL-AIR CORE .136 DIA/22GA/4T	1596-0282		
L4	COIL-AIR CORE .135 DIA/22GA/4T	1596-0282		
	TRANSISTOR			
Q1	XSTR-2N5179 NPN SI TO92 LOW PWR (MOTA)	1272-0060	Motorola	2N5179
Q2	XSTR-2N5109 NPN SI TO39 HIGH PWR	1272-0110	Motorola	2N5109
	RESISTOR			
R1	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R2	RES-13 OHM 1% 100PPM FILM	1075-0172	Shelly	RN55D
R3	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R4	RES-620 OHM 5% 1/4W CC	1066-1615	A. Bradley	CB1615
R5	RES-620 OHM 5% 1/4W CC	1066-6215	A. Bradley	CB6215
R6	RES-27 OHM 5% 1/4W CC	1066-2705	A. Bradley	CB2705
R7	RES-27 OHM 5% 1/4W CC	1066-2705	A. Bradley	CB2705
R8	RES-27 OHM 5% 1/4W CC	1066-2705	A. Bradley	CB2705
R9	RES-620 OHM 5% 1/4W CC	1066-6215	A. Bradley	CB6215
R10	RES-150 OHM 5% 1/4W CC	1066-1515	A. Bradley	CB1515
R11	RES-39 OHM 5% 1/4W CC	1066-3906	A. Bradley	CB3905
R12	RES-150 OHM 5% 1/4W CC	1066-1515	A. Bradley	CB1515
R13	RES-5.62K 100PPM FILM	1075-0013	CAT.LIST	55-100
R14	RES-100K 1% 100PPM	1075-0105	CAT.LIST	55-100
R15	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R16	RES-51 OHM 5% 1/8W CC	1065-5105	A. Bradley	BB5105

Table 6-9. 20 MHz Sampler, (3400), Parts List (Concluded)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R17	RES-51 OHM 5% 1/8W CC	1065-5105	A. Bradley	BB5105
R18	RES-2K 5% 1/8W CC	1065-2025	A. Bradley	BB2025
R19	RES-2K 5% 1/8W CC	1065-2025	A. Bradley	BB2025
R20	RES-51 OHM 5% 1/8W CC	1065-5105	A. Bradley	BB5105
R21	RES-150K 5% 1/4W CC	1066-1545	A. Bradley	CB1545
R22	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R23	RES-10MEG 5% 1/4W CC	1066-1065	A. Bradley	AB1065
R24	RES-10K 1% 100PPM FILM	1075-0009	CAT.LIST	55-100
R25	RES-36.5K 1% 100PPM FILM	1075-0113	CAT.LIST	55-100
	TRANSFORMER			
T1	XFMR-TOROIDAL BIFILAR	1579-0053	Cushman	C/E Dwg&M/L
	INTEGRATED CIRCUIT			
U1	IC-CA 3140E 8 PIN DIP OP AMPL	2025-2037		

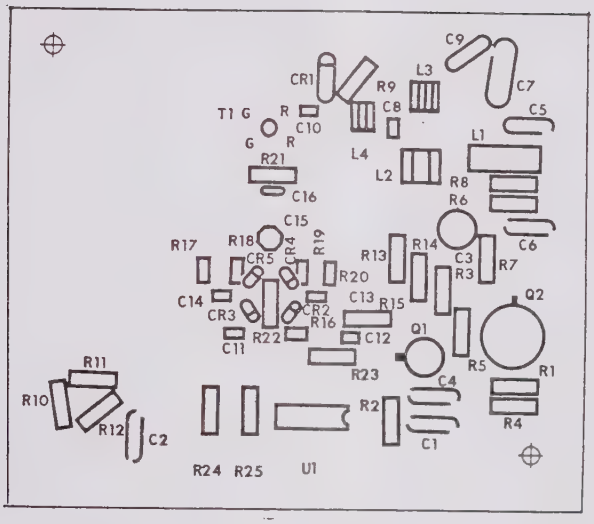


Figure 6-20. 20 MHz Sampler (3400) Component Location.

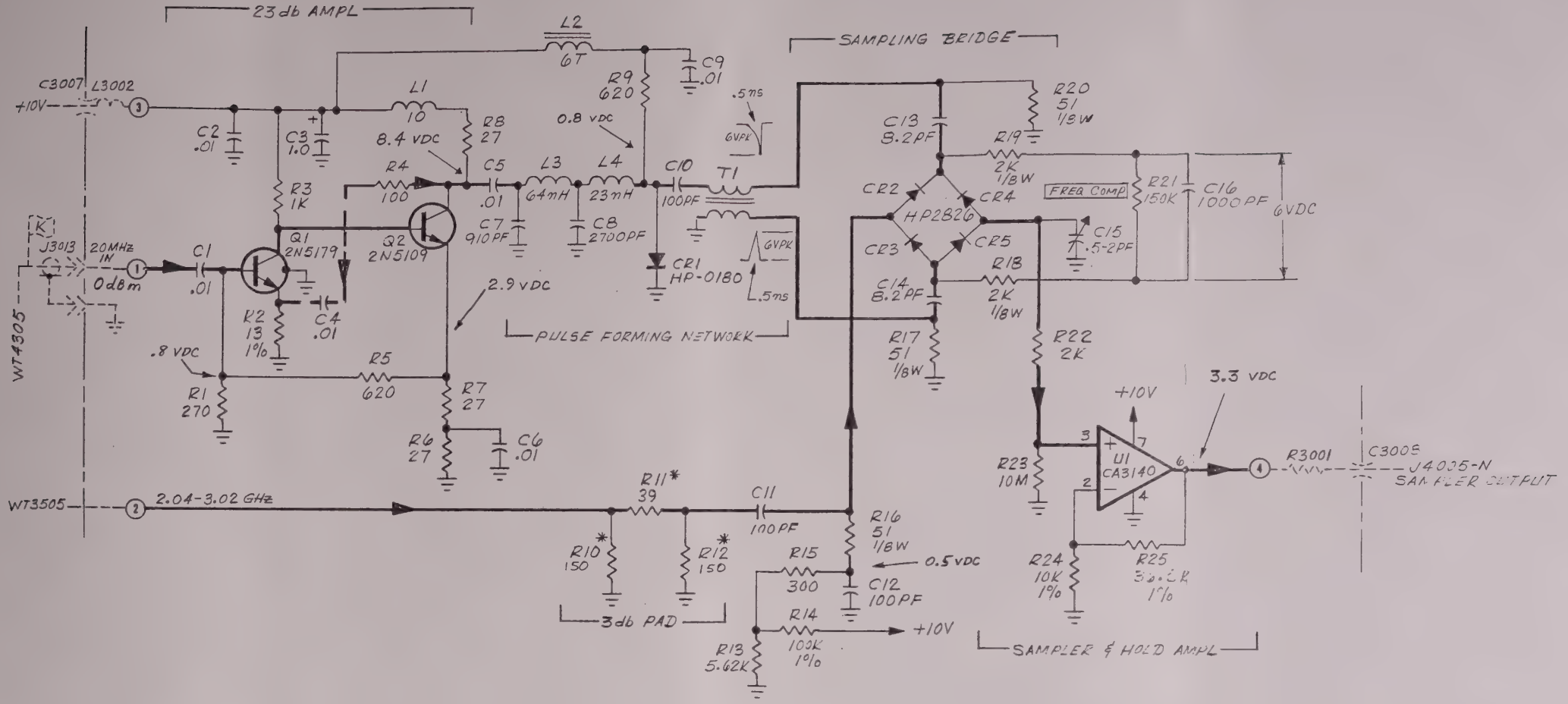


Figure 6-21. 20 MHz Sampler (3400) Schematic Diagram.

Table 6-10. Final Mixer/LPF, (3500) Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
3500	PCB ASSY - Final Mixer/LPF	7001-0645	Cushman	CE-4000
	Printed Circuit Board	1780-1103	Cushman	
	CAPACITOR			
C1	CAP-12PF 5% 50V NPO CHIP	1012-0005	Varadyne	3BN050S120JS
C2	CAP-1PF 0.5PF 50V NPO CHIP	1012-0019	Vitramon	VJ0805A1R0DH
C3	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C4	CAP-12PF 5% 50V NPO CHIP	1012-0005	Varadyne	3BN050S120JS
C5	CAP-1.5PF 0.25PF 50V NPO CHIP	1012-0002	Viclan	0805NP01R5C 50PS
C6	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C7	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C8	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C9	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C10	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011A28
	DIODE			
CR1	DIO-HP2826 HOT CARR 1.2PF A1N 15PRV BM	1283-0005	HP	5082-2826
CR2	DIO-HP2826 HOT CARR 1.2PF A1N 15PRV BM	1283-0005	HP	5082-2826
CR3	DIO-BA379 S1 PIN	1281-0101	Siemens	BA379
CR4	DIO-BA379 S1 PIN	1281-0101	Siemens	BA379
	TRANSISTOR			
Q1	XSTR-NE57835 NPN S1 LOW PWR	1272-0086	Nippon Elec	NE57835

Table 6-10. Final Mixer/LPF, (3500) Parts List (Concluded)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	RESISTOR			
R1	RES-51 OHM 5% 1/8W CC	1065-5105	A. Bradley	BB5105
R2	RES-22 OHM 5% 1/8W CC	1065-2205		
R3	RES-150 OHM 5% 1/8W CC	1065-1515	A. Bradley	BB1515
R4	RES-430 OHM 5% 1/8W CC	1065-4315	A. Bradley	BB4315
R5	RES-270 OHM 5% 1/8W CC	1065-2715	A. Bradley	BB2715
R6	RES-3.3K 5% 1/8W CC	1065-3325	A. Bradley	BB3325
R7	RES-110 OHM 5% 1/4W CC	1065-1115	A. Bradley	CB1115
R8	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R9	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R10	RES-6.8K 5% 1/4W CC	1066-6825	A. Bradley	CB6825
R11	RES-18 OHM 5% 1/8W CC	1065-1805	A. Bradley	BB1805
R12	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R13	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R14	RES-18 OHM 5% 1/4W CC	1066-1805	A. Bradley	CB1805
R15	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
	TRANSFORMER			
T1	XFMR-TOROIDIAL BIFILAR	1579-0042		

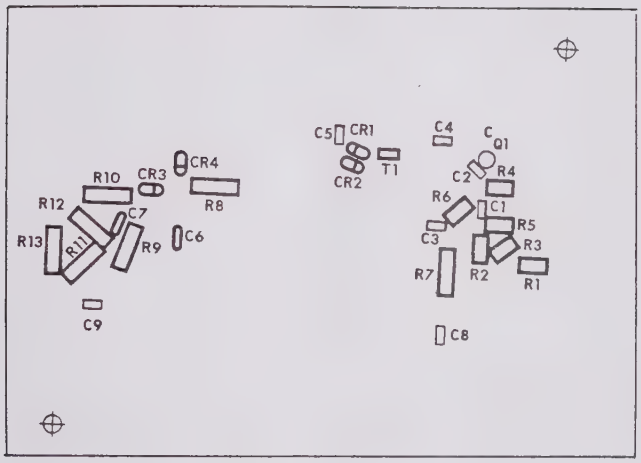


Figure 6-22. Final Mixer/LP Filter (3500) Component Location.

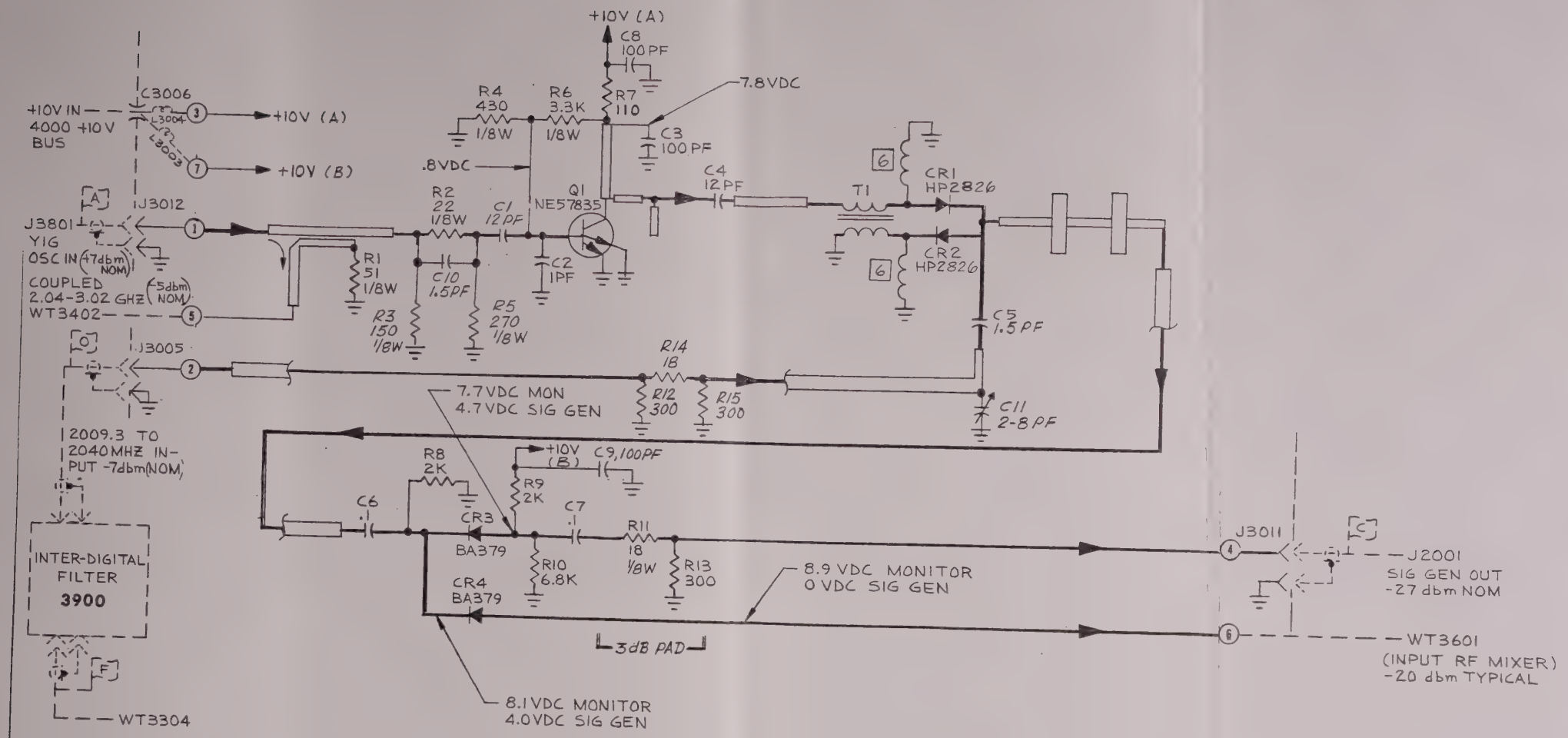


Figure 6-23. Final Mixer/LP Filter (3500) Schematic Diagram.

Table 6-11. Receiver/Converter Assembly (3600), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
3600	PCB ASSY - Receive/ Converter	7001-0646	Cushman	CE-4000
	Printed Circuit Board	1780-1104	Cushman	
	MIXER			
BM1	MXR-TFM-2 DBL1 BAL 1-1000MHz	2010-0011	Mini Circuits	TFM-2
	CAPACITOR			
C1	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C2	CAP-0.1UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C3	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C4	CAP-0.01UF 5% 50V W5R CHIP	1012-0013	Electro	0805EM050U 103J
C5	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C6	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C7	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C8	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C9	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C10	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C11	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A
C12	CAP-220PF 10% 100V W5R MINTR CER	1005-0075	Erie	8101100X7R0 221K
C13	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C16	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C17	CAP-100PF 10% 50V NPO CHIP	1012-0004	Novacap	0805N101K500A

Table 6-11. Receiver/Converter Assembly (3600), Parts List (Concluded)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	DIODE			
CR2	DIO-1N3062 SI SW DO7 1PF 75PRV	1281-0080	ITT	1N3062
CR3	DIO-1N3062 SI SW DO7 1PF 75PRV	1281-0080	ITT	1N3062
	INDUCTOR			
L2	CH-3B FERRITE BEAD 30GA/6T	1586-0007		
L3	CH-0.22UH 20% RF MLD AXL .16DX.38L	1585-0039	Delevan	1537-02
L4	CH-0.22UH 20% RF MLD AXL .16DX.38L	1585-0039	Delevan	1537-02
L5	CH-0.22UH 20% RF MLD AXL .16DX.38L	1585-0039	Delevan	1537-02
	TRANSISTOR			
Q1	XSTR-NE57835 NPN S1 LOW PWR	1272-0086	Nippon Elec	NE57835
Q2	XSTR-NE57835 NPN S1 LOW PWR	1272-0086	Nippon Elec	NE57835
Q3	XSTR-NE57835 NPN S1 LOW PWR	1272-0086	Nippon Elec	NE57835
	RESISTOR			
R1	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R2	RES-27K1 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R3	RES-100 OHM 5% 1/8W CC	1065-1015	A. Bradley	BB1015
R4	RES-430 OHM 5% 1/8W CC	1065-4315	A. Bradley	BB4315
R5	RES-22 OHM 5% 1/8W CC	1065-2205		
R6	RES-22 OHM 5% 1/8W CC	1065-2205		
R7	RES-390 OHM 5% 1/8W CC	1065-3915	A. Bradley	BB3915
R8	RES-82 OHM 5% 1/8W CC	1065-8205	A. Bradley	BB8205
R10	RES-470 OHM 5% 1/8W CC	1065-4715	A. Bradley	BB4715
R11	RES-22 OHM 5% 1/8W CC	1065-2205		
R12	RES-56 OHM 5% 1/8W CC	1065-5605	A. Bradley	BB5605
R13	RES-2.7K 5% 1/8W CC	1065-2725	A. Bradley	BB2725
R14	RES-430 OHM 5% 1/8W CC	1065-4315	A. Bradley	BB4315
R15	RES-100 OHM 5% 1/8W CC	1065-1015	A. Bradley	BB1015
R16	RES-150 OHM 5% 1/4W CC	1066-1515	A. Bradley	CB1515

Table 6-11. Receive/Converter (3600), Parts List(Concluded)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R17	RES-51 OHM 5% 1/4W CC	1066-5105	A. Bradley	CB5105
R18	RES-39 OHM 5% 1/4W CC	1066-3905	A. Bradley	CB3905
R19	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R20	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015

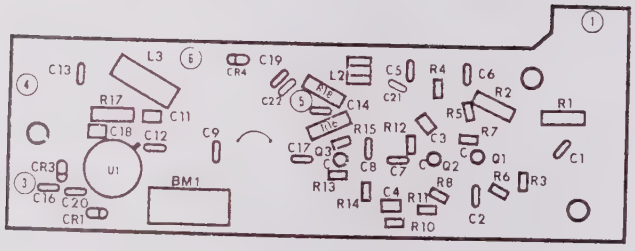


Figure 6-24. Receiver/Converter (3600) Component Location.

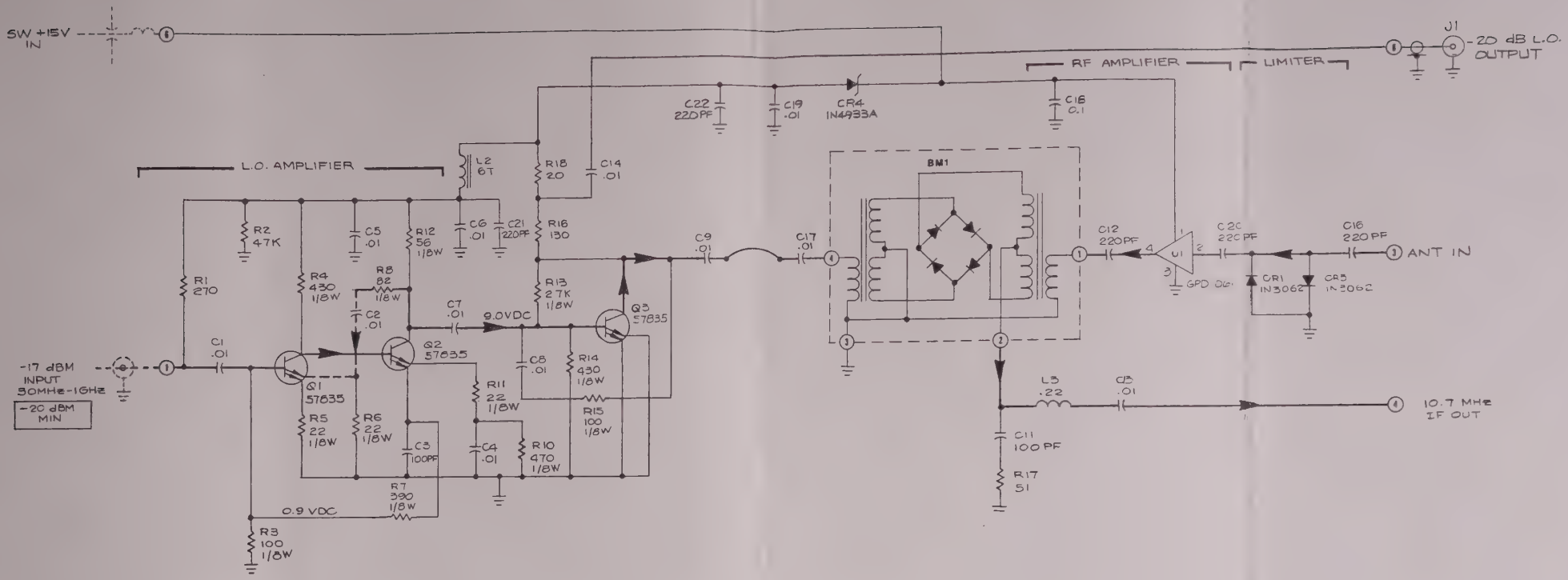


Figure 6-25. Receiver/Converter (3600) Schematic Diagram.

Table 6-12. Receive/Converter Regulator, (3950), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
3950	PCB ASSY-RCVR CONV REGULATOR	7001-8813	Cushman	
	CAPACITOR			
C1	CAP-10UF 20% 50V RDL ELCTLT	1013-0046	Nichicon	50VKB10M
C2	CAP-10UF 20% 35V RDL ELCTLT	1013-0044	Nichicon	35UKB10M
	DIODE			
CR1	DIO-1N4002 SI RECT A23F 100PRV 1A	1281-0023	ITT	1N400Z
	RESISTOR			
R1	RES-47 OHM 5% IW CC	1068-4705	A. Bradley	CB4705
R2	RES-4.99K 1% 100PPM FILM	1075-0095	CAT.LIST	55-100
R3	RES-11K 1% 100PPM FILM	1074-0106	CAT.LIST	55-100
R4	RES-5.9K 1% 100PPM FILM	1075-0110	CAT.LIST	55-100
R5	RES-200 OHM 5% 1/4W CC	1066-2015	CAT.LIST	55-100
R6	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R7	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
	TRANSISTOR			
Q1	XSTR-2N3053 NPN SI TO 5 HIGH PWR	1272-0011	RCA	2N3053
Q2	XSTR-2N3904 NPN SI TO 92 LOW PWR/S	1272-0032	Motorola	2N3904
	CONNECTOR			
J1	CONN-4 PIN 0.1SP STR LKG PCB MT JK	2535-0144	Molex Inc	22272041
J2	CONN-2 PIN 01.SP STR LKG PCB MT JK	2535-0142	Molex Inc	22272021
J3	CONN-2 PIN 01.SP STR LKG PCB MT JK	2535-0142	Molex Inc	22262021
	INTEGRATED CIRCUIT			
U1	IC-CA 3140E 8 PIN DIP OP AMPL	2025-0237	RCA	CA3140E

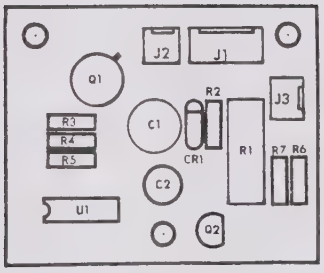


Figure 6-26. Receiver Converter Regulator (3950) Component Location.

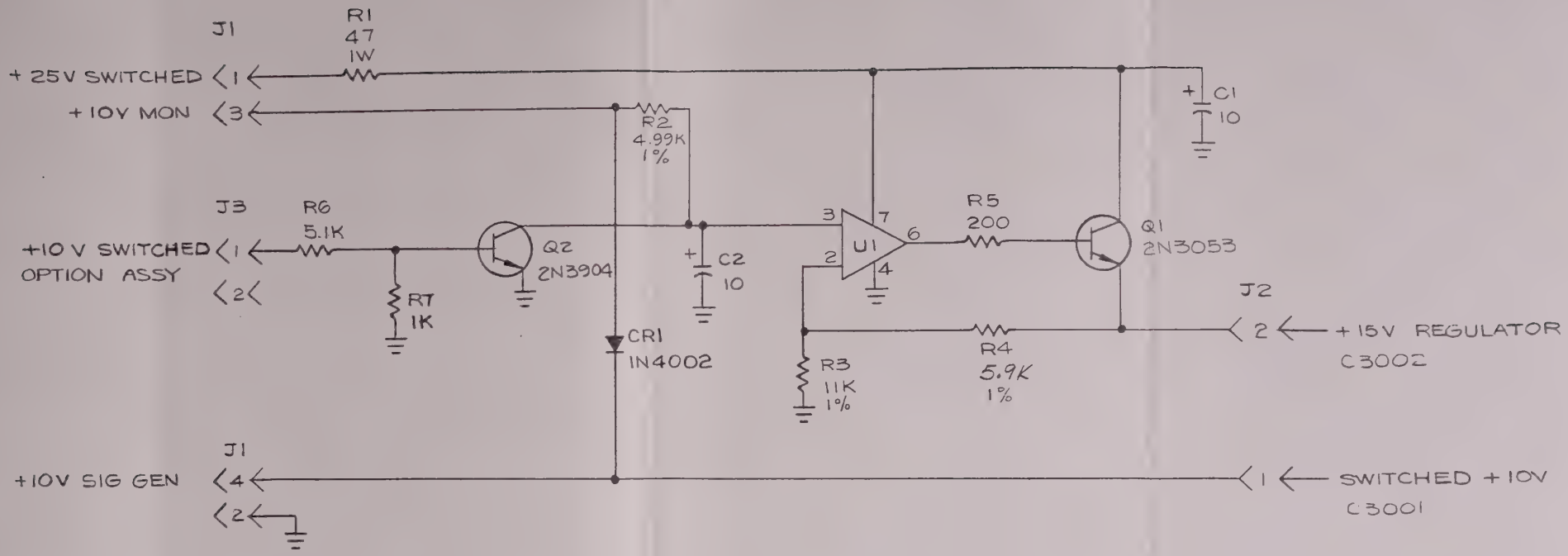


Figure 6-27. Receiver Converter Regulator (3950) Schematic Diagram.

Table 6-13. Divide-By-M PLL (4100), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
4100	PCB ASSY - DIVIDE BY M PLL Printed Circuit Board	7001-0632	Cushman	CE-4000
	CAPACITOR			
C1	CAP-0.01UF 80-20% 25V Y5P CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C2	CAP-0.05UF 80-20% 25V Y5P CER DISC	1005-0014	Tusonix	5835512Y5U 103Z
C3	CAP-0.01UF 80-20% 25V Y5P CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C4	CAP-0.33UF 5% 100V RDL MET-POLYEST	1008-0109	Plessey	60E334J100
C5	CAP-0.47UF 5% 100V RDL MET-POLYEST	1008-0110	Plessey	60F474J100
C6	CAP-0.68UF 10% 100V RDL MET-POLYEST	1008-0108	Plessey Capacitors	60G684K100
C7	CAP-0.01UF +80-20% 25V Y5P CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C8	CAP-150PF 5% 500V DIP MICA	1002-0021	Arco	ADM15FD151J
C9	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Panasonic	ECEA1HV010S
C10	CAP-0.01UF 80-20% 25V Y5P CER DISC	1013-0047	Tusonix	5835512Y5U 103Z
C11	CAP-0.01UF 80-20% 25V Y5P CER DISC	1013-0047	Tusonix	5835512Y5U 103Z
C12	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Panasonic	ECEA1HV010S
C13	CAP-100PF 5% 500V DIP MICA	1002-0011	Elmenco	DM15-F-101J
C14	CAP-100PF 5% 500V DIP MICA	1002-0011	Elmenco	DM15-F-101J
C15	CAP-150PF 5% 500V DIP MICA	1002-0021	Arco	ADM15FD151J
C16	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25
C17	CAP-0.01UF 80-20% 25V Y5P CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C18	CAP-820PF 10% 1KV Z5R CER DISC	1005-0047	Centralab	DD821
C19	CAP-820PF 10% 1KV Z5R CER DISC	1005-0047	Centralab	DD821

Table 6-13. Divide-By-M PLL (4100), Parts List (Continued)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C20	CAP-0.1UF 10% 100V RDL MET-POLYEST	1008-0098	Plessey	60C104K100
C21	CAP-0.1UF 10% 100V RDL MET-POLYEST	1008-0098	Plessey	60C104K100
C22	CAP-390PF 5% 100V DIP MICA	1004-0017	Cornell Dubilier	CD10FA391J
C23	CAP-1500PF 5% 500V DIP MICA	1002-0083	Elmenco	DM19-E-152J
C24	CAP-1500PF 5% 500V DIP MICA	1002-0083	Elmenco	DM19-E-152J
C25	CAP-1500PF 5% 500V DIP MICA	1002-0083	Elmenco	DM19-E-152J
C26	CAP-1500PF 5% 500V DIP MICA	1002-0083	Elmenco	DM19-E-152J
C27	CAP-0.01UF 80-20% 25V Y5P CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C28	CAP-56PF 5% 500V DIP MICA	1002-0019	Elmenco	DM15-E-560J
C29	CAP-0.01UF 80-20% 25V Y5P CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C30	CAP-0.01UF 80-20% 25V Y5P CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C31	CAP-0.01UF 80-20% 25V Y5P CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C32	CAP-0.01UF 80-20% 25V Y5P CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C33	CAP-0.01UF 80-20% 25V Y5P CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C34	CAP-0.01UF 80-20% 25V Y5P CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C35	CAP-0.1UF 10% 100V RDL MET-POLYESTER	1008-0098	Plessey	60C104K100
	DIODE			
CR1	DIO-1N3064 S1 SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR2	DIO-1N3064 S1 SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR3	DIO-1N3064 S1 SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR4	DIO-1N3064 S1 SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064

Table 6-13. Divide-By-M PLL (4100), Parts List (Continued)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
CR5	DIO LT EMIT W ANG W/MTG GROM	1281-0073	Chicago Mini Lamp	CM4-73 W/Mount
CR6	DIO-1N3064 S1 SW D07/D035 75PRV 0.25W	1281-0013	Fairchild	1N3064
	INDUCTOR			
L1	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
L2	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
L3	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
L4	CH-2 1/2 TURN WIDEBAND	1586-0003	Ferroxcube	VK20020/4B
	TRANSISTOR			
Q1	XSTR-2N3906 PNP SI S1 to 92 LOW PWR/SW	1272-0037	Motorola	
Q2	XSTR-2N3904 NPN SI S1 to 92 LOW PWR/SW	1272-0032	Motorola	
Q3	XSTR-2N3904 NPN SI S1 to 92 LOW PWR/SW	1272-0032	Motorola	
Q4	XSTR-2N3904 NPN SI S1 to 92 LOW PWR/SW	1272-0032	Motorola	
Q5	XSTR-2N3904 NPN SI S1 to 92 LOW PWR/SW	1272-0032	Motorola	
Q6	XSTR-MPSA42 N SI S1 to 92 LOW PWR	1272-0089	Motorola	
Q7	XSTR-2N3904 NPN SI S1 to 92 LOW PWR/SW	1272-0032	Motorola	
Q8	XSTR-2N3904 NPN SI S1 to 92 LOW PWR/SW	1272-0032	Motorola	
Q9	XSTR-MPSH81 PNP SI S1 to 92 LOW PWR	2373-0222	Motorola	
	RESISTOR			
R1	RES-1.8K 5% 1/4W CC	1066-1825	A. Bradley	CB1825
R2	RES-1.8K 5% 1/4W CC	1066-1825	A. Bradley	CB1825
R3	RES-1.8K 5% 1/4W CC	1066-1825	A. Bradley	CB1825
R4	RES-8.2K 5% 1/4W CC	1066-8225	A. Bradley	CB8225
R5	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R6	RES-20K 5% 1/4W CC	1066-2035	A. Bradley	CB2035

Table 6-13. Divide-By-M PLL (4100), Parts List (Continued)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R7	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R8	RES-15K 5% 1/4W CC	1066-1535	A. Bradley	CB1535
R9	RES-15K 5% 1/4W CC	1066-1535	A. Bradley	CB1535
R10	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R11	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R12	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R13	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R14	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R15	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R16	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R17	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R18	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R19	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R20	RES-180 OHM 5% 1/4W CC	1066-1815	A. Bradley	CB1815
R21	RES-130 OHM 5% 1/4W CC	1066-1315	A. Bradley	CB1315
R22	RES-820 OHM 5% 1/4W CC	1066-8215	A. Bradley	CB8215
R23	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R24	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R25	RES-470 OHM 5% 1/4W CC	1066-4715	A. Bradley	CB4715
R26	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R27	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R28	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R29	RES-470 OHM 5% 1/4W CC	1066-4715	A. Bradley	CB4715
R30	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R31	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R32	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R33	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R34	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R35	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R36	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R37	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R38	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R39	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R40	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R41	POT-10K 10% 3/4W 15T CERMET TRMR	1215-0014	Helitrim	89WR10K
R42	RES-2.1K 1% 100PPM FILM	1075-0167	CAT.LIST	55-100
R43	RES-1.05K 1% 100PPM FILM	1075-0086	CAT.LIST	55-100
R44	RES-2.1K 1% 100PPM FILM	1075-0167	CAT.LIST	55-100
R45	RES-27 OHM 5% 1/4W CC	1066-2705	A. Bradley	CB2705
R46	RES-470 OHM 5% 1/4W CC	1066-4715	A. Bradley	CB4715
R47	RES-1K 5%K 1/4W CC	1066-1025	A. Bradley	CB1025
R48	RES-27 OHM 5% 1/4W CC	1066-2705	A. Bradley	CB2705

Table 6-13. Divide-By-M PLL (4100), Parts List (Continued)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R49	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R50	RES-30K 5% 1/4W CC	1066-3035	A. Bradley	CB3035
R51	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R52	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R53	RES-27 OHM 5% 1/4W CC	1066-2705	A. Bradley	CB2705
R54	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R55	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1036
RN1	RNET-9/1.8K 2% 100PPM 10 PIN SIP	1115-0004	Dale	MSP10C01182G
RN2	RNET-9/10K 2% 100PPM 10 PIN SIP	1115-0005	Dale	MSP10C01103G
	INTEGRATED			
U1	IC-74LS51 14 PIN DIP AND-OR-INVERT	2025-0259	Texas Instruments	SN74LS51N
U2	IC-74LS51 14 PIN DIP AND-OR-INVERT	2025-0259	Texas Instruments	SN74LS51N
U3	IC-74LS51 14 PIN DIP AND-OR-INVERT	2025-0259	Texas Instruments	SN74LS51N
U4	IC-74LS51 14 PIN DIP AND-OR-INVERT	2025-0259	Texas Instruments	SN74LS51N
U5	IC-74LS190 16 PIN DIP BCD UP/DOWN CNTR	2025-0263	Texas Instruments	SN74LS190N
U6	IC-74LS190 16 PIN DIP BCD UP/DOWN CNTR	2025-0263	Texas Instruments	SN74LS190N
U7	IC-74LS51 14 PIN DIP AND-OR-INVERT	2025-0259	Texas Instruments	SN74LS51N
U8	IC-74LS51 14 PIN DIP AND-OR-INVERT	2025-0259d	Texas Instruments	SN74LS51N
U9	IC-SN74LS196N DECADE COUNTERS	2025-0111	Texas Instruments	SN74LS196N
U10	IC-74LS190 16 PIN DIP BCD UP/DOWN CNTR	2025-0263	Texas Instruments	SN74LS190N
U11	IC-74LS112 16 PIN DUAL J-K FLIPFLOP	2025-0221	National	DM74LS112N
U12	IC-74LS190 16 PIN DIP BCD UP/DOWN CNTR	2025-0263	Texas Instruments	SN74LS190N
U13	IC-74ALS20 14 PIN DIP 4-INP NAND	2025-0257	Texas Instruments	SN74ALS20N
U14	IC-74ALS20 14 PIN DIP 2-INP NAND GATES	2025-0312	Texas Instruments	SN74LS00N

Table 6-13. Divide-By-M PLL (4100), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
U15	IC-74LS190 16 PIN DIP BCB UP/DOWN CNTR	2025-0263	Texas Instruments	SN74LS190N
U16	IC-SN74LS04N HEW INVERTOR	2025-0084	Texas Instruments	SN74LS04N
U17	IC-74LS112 16 PIN DIP DUAL J-K FLIPFLOP	2025-0221	National	DM74LS112N
U18	IC-SN74LS73N DUAL J-K FLIPFLOP	2025-0110	Texas Instruments	SN74LS73N
U19	IC-74ALS74 14 PIN DIP DUAL D FLIPFLOP	2025-0260	Texas Instruments	SN74ALS74N
U20	IC-74LS190 16 PIN DIP BCD UP/DOWN CNTR	2025-0263	Texas Instruments	SN74LS190N
U21	IC-74LS32 14 PIN DIP QUAD 2-INP OR	2025-0258	Texas Instruments	SN74LS32N
U22	IC-74LS00 14 PIN DIP 2-INP NAND GATES	2025-0312	Texas Instruments	SN74LS00N
U23	IC-3130 8 PIN DIP OP AMPL	2025-0269	RCA	CA3130E
U24	IC-74LS20 14 PIN DIP DUAL 4-INP NAND	2025-0216	National	DM74LS20N
U25	IC-SN74LS73N DUAL J-K FLIPFLOP	2025-0110	Texas Instruments	SN74LS73N
U26	IC-74LS00 14 PIN DIP 2-INP NAND GATES	2025-0312	Texas Instruments	SN74LS00N

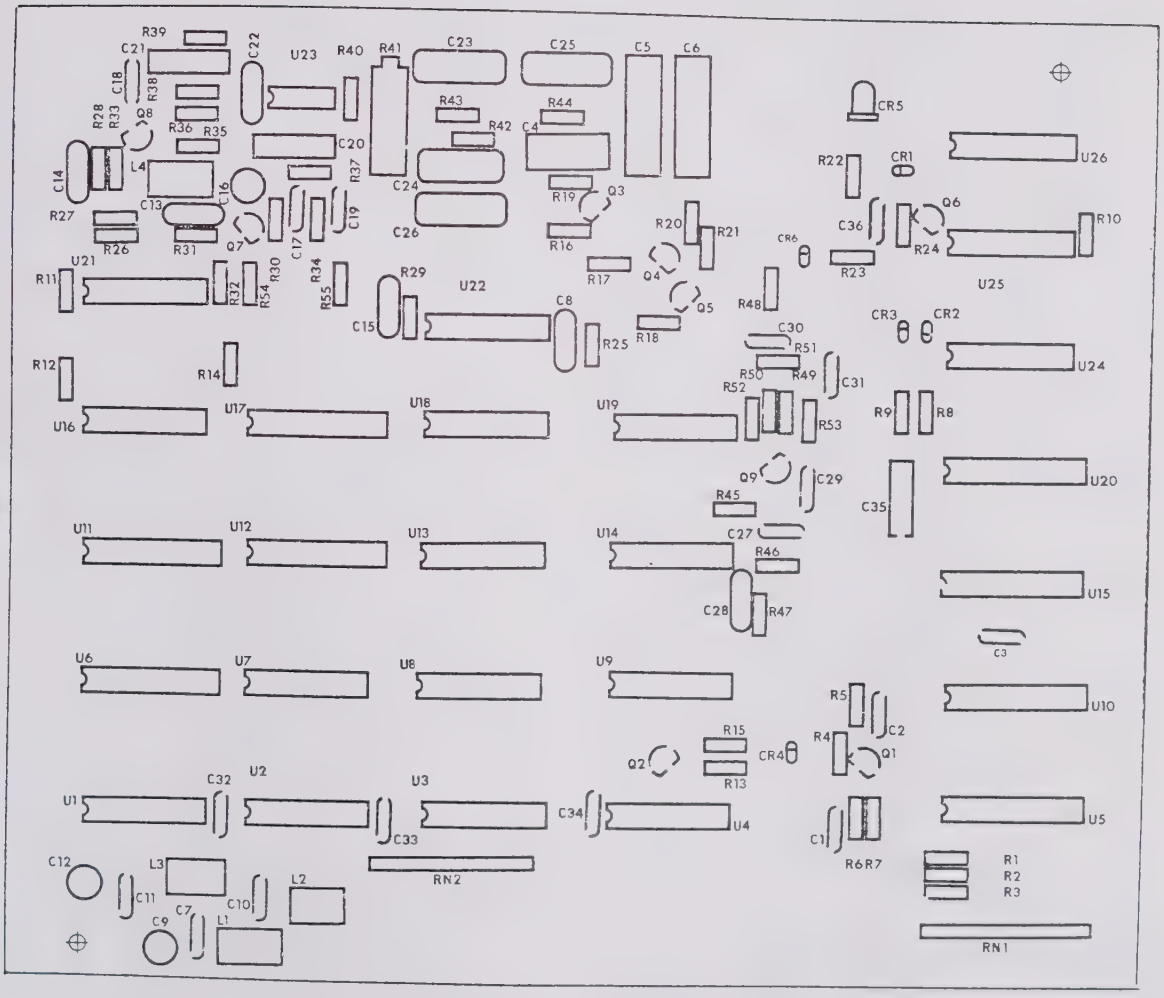


Figure 6-28. Divide-By-M PLL (4100) Component Location.

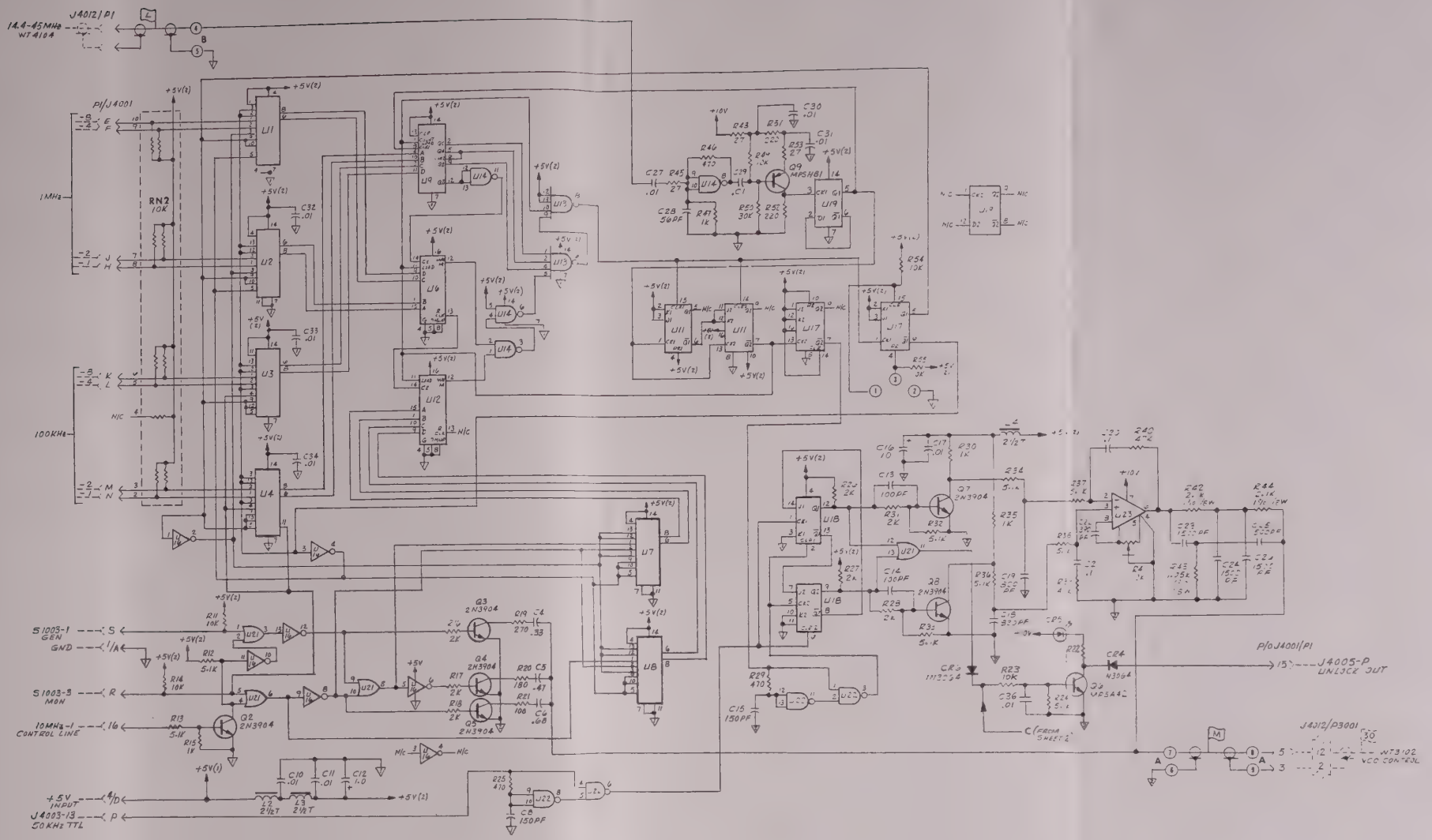


Figure 6-29. Divide-By-M PLL (4100) Schematic Diagram.

Table 6-14. 100 Hz Synth/Fixed Divider, (4200) Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
4200	PCB ASSY - 100 Hz SYNTH Printed Circuit Board	7001-0633 1780-1117	Cushman Cushman	CE-4000
	MIXER			
BM1	MXR-SBL-1 DBL BAL 1-500MHz	2010-0009	Mini Circuits Lab	SBL-1
BM2	MXR-SBL-1 DBL BAL 1-500MHz	2010-0009	Mini Circuits Lab	SBL-1
BM3	MXR-SBL-1 DBL BAL 1-500MHz	2010-0009	Mini Circuits Lab	SBL-1
	CAPACITOR			
C1	CAP-0.05UF +80-20% 25V Y5P CER DISC	1005-0014		5835514Y5U 503Z
C2	CAP-820PF 5% 300V DIP MICA	1002-0039	Elmenco	DM15-F-821J
C3	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap.	10PC25
C4	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C5	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C6	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0014	Tusonix	5835512Y5U 503Z
C7	CAP-220PF 5% 500V DIP MICA	1002-0029	Elmenco	CM15-F-221J
C8	CAP-0.68UF 10% 100V RDL MET-POLYEST	1008-0108	Plessey Capacitors	60G 684 K 100
C9	CAP-0.022UF 5% 400V RDL POLYESTER	1008-0094	Plessey Capacitors	60C 223 J 400
C10	CAP-0.05UF +80-20% 25V Y5U CER DISC	1005-0014	Tusonix	5835512Y5U 503Z
C11	CAP-2-8PF 350V NPO V MT CER TRMR	1001-004	Tusonix	538011A28
C12	CAP-100PF 5% 500V DIP MICA	1002-0011	Elmenco	DM15-F-101J
C13	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011A28
C14	CAP-100PF 5% 500V DIP MICA	1002-0011	Elmenco	DM15-F-101J
C15	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011A28

Table 6-14. 100 Hz Synth/Fixed Divider, (4200), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C16	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C17	CAP-0.002UF 20% 500V Z5U CER DISC	1005-0003	Tusonix	831596Z5U202M
C18	CAP-0.05UF +80-20% 25V Y5U CER DISC	1005-0014	Tusonix	5835512Y5U 503Z
C19	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C20	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C21	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C22	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C23	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C24	CAP-0.05UF +80-20% 25V Y5U CER DISC	1005-0014	Tusonix	5835512Y5U 503Z
C25	CAP-0.05UF +80-20% 25V Y5U CER DISC	1005-0014	Tusonix	5835512Y5U 503Z
C26	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C27	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C28	CAP-27PF 5% 500V DIP MICA	1002-0008	Elmenco	DM15-E-270J
C29	CAP-250PF 5% 500V DIP MICA	1002-0061	Elmenco	DM15-F-251J
C30	CAP-2-8PF 350V NPO V MT CER TRMR	1001-004	Tusonix	538011A28
C31	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15-E-510J
C32	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011A28
C33	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15-E-510J
C34	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011A28
C35	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C36	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C37	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z

Table 6-14. 100 Hz Synth/Fixed Divider, (4200) Parts List
(Continued)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C38	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C39	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C40	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C41	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C42	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C43	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C44	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C45	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C46	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C47	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C48	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C49	CAP-33PF 5% 500V DIP MICA	1002-0024	Elmenco	DM15-E-220J
C50	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C51	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C52	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C53	CAP-33PF 5% 500V DIP MICA	1002-0024	Elmenco	DM15-E-220J
C54	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011A28
C55	CAP-100PF 5% 500V DIP MICA	1002-0011	Elmenco	DM15-F-101J
C56	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011A28
C57	CAP-100PF 5% 500V DIP MICA	1002-0011	Elmenco	DM15-F-101J
C58	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538-11A28
C59	CAP-330PF 5% 500V DIP MICA	1002-0032	Elmenco	DM15-F-331J

Table 6-14. 100 Hz Synth/Fixed Divider, (4200) Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C60	CAP-560PF 5% 300V DIP MICA	1002-0037	Sangamo	D155F561
C61	CAP-560PF 5% 300V DIP MICA	1002-0037	Sangamo	D155F561
C62	CAP-330PF 5% 500V DIP MICA	1002-0032	Elmenco	DM15-F-331J
C63	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C64	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C65	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C66	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C67	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C68	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C69	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C70	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C71	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C72	CAP-27PF 5% 500V DIP MICA	1002-0008	Elmenco	DM15-E-270J
C73	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C74	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C75	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C76	CAP-0.05UF +80-20% 25V Y5U CER DISC	1005-0014	Tusonix	5835512Y5U 503Z
C77	CAP-220PF 5% 500V DIP MICA	1002-0029	Elmenco	DM15-F-221J
C78	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C79	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C80	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C81	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z

Table 6-14. 100 Hz Synth/Fixed Divider, (4200)300) Parts, List
(Continued)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C82	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C83	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C84	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C85	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C86	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
	DIODE			
CR1	DIO-MV1650 SI VARICAP D07 100PF 20V	1281-0037		MV1650
CR2	DIP-MV1650 SI VARICAP D07 100PF 20V	1281-0037		MV1650
CR3	DIP-BA379 SI PIN	1281-0101	Siemens	BA379
CR4	DIO-1N32064 SI SW D035 75PRV 0.25W	1281-0105	Fairchild	1N3064D035PKG
CR5	DIO-1N3064 SI SW D035 75PRV 0.25W	1281-0105	Fairchild	1N3064D035PKG
CR6	DIO-1N3064 SI SW D035 75PRV 0.25W	1281-0105	Fairchild	1N3064D035PKG
CR7	DIO-1N3064 SI SW D035 75PRV 0.25W	1281-0105	Fairchild	1N3064D035PKG
CR8	DIO-BA379 SI PIN	1281-0101	Siemens	BA379
CR9	DIO-BA379 SI PIN	1281-0101	Siemens	BA379
CR10	DIO-BA379 SI PIN	1281-0101	Siemens	BA379
CR11	DIO-BA379 SI PIN	1281-0101	Siemens	BA379
CR12	DIO-BA379 SI PIN	1281-0101	Siemens	BA379
CR13	DIO-BA379 SI PIN	1281-0101	Siemens	BA379
CR14	DIO-1N3064 SI SW D035 75PRV 0.25W	1281-0105	Fairchild	1N3064D035PKG
CR15	DIO-1N3064 SI SW D07/D035 74PRV 0.25W	1281-0013	Fairchild	1N3064
	INDUCTOR			
L1	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
L2	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B

Table 6-14. 100 Hz Synth/Fixed Divider (4200) Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
L3	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
L4	CH-2.2UH 10% RF MLD AXL .16DX.38L	1585-0013	Delevan	1537-20
L5	CH-2.2UH 10% RF MLD AXL .16DX.38L	1585-0013	Delevan	1537-20
L6	CH-2.2UH 10% RF MLD AXL .16DX.38L	1585-0013	Delevan	1537-20
L7	CH-100UH 5% RF MLD AXL .16DX.38L	1585-0017	Delevan	1537-76
L8	CH-18UH 10% RF MLD AXL .16DX.38L	1585-0089	Delevan	1537-42
L9	CH-0.22UH 20% RF MLD AXL .16DX.38L	1585-0039	Delevan	1537-02
L10	CH-0.39UH 10% RF MLD AXL .10DX.25L	1585-0062	SAE	SU1-0.39
L11	CH-3.3UH 10% RF MLD AXL .16DX.38L	1585-0037	Delevan	1537-24
L12	CH-2.2UH 10% RF MLD AXL .16DX.38L	1583-0013	Delevan	1537-20
L13	CH-2.2UH 10% RF MLD AXL .16DX.38L	1583-0013	Delevan	1537-20
L14	CH-2.2UH 10% RF MLD AXL .16DX.38L	1585-0013	Delevan	1537-20
L15	CH- 22UH 10% RF MLD AXL .16DX.38L	1585-0012	Delevan	1537-44
L16	CH-0.39UH 10% RF MLD AXL .10DX.25L	1585-0062	SAE	SU1-0.39
L17	CH- 22UH 10% RF MLD AXL .16DX.38L	1585-0012	Delevan	1537-44
L18	CH-0.39UH 10% RF MLD AXL .10DX.25L	1585-0062	SAE	SU1-0.39
L19	CH-2.2UH 10% RF MLD AXL .16DX.38L	1585-0013	Delevan	1537-20
L20	CH-2.2UH 10% RF MLD AXL .16DX.38L	1585-0013	Delevan	1537-20
L21	CH-2.2UH 10% RF MLD AXL .16DX.38L	1585-0013	Delevan	1537-20
L22	CH-3.3UH 10% RF MLD AXL .16DX.38L	1585-0037	Delevan	1537-24
L23	CH-3.9UH 10% RF MLD AXL .16DX.38L	1585-0014	Delevan	1537-26
L24	CH-3.3UH 10% RF MLD AXL .16DX.38L	1585-0037	Delevan	1537-24

Table 6-14. 100 Hz Synth/Fixed Divider (4200), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
L25	CH-22UH 10% RF MLD AXL .16DX.38L	1585-0012	Delevan	1537-44
L26	CH-0.39UH 10% RF MLD AXL .10DX.25L	1585-0062	SAE	SU1-0.39
	TRANSISTOR			
Q1	XSTR-2N3906 PNP S1 to 92 LOW PWR/SW	1272-0037	Motorola	2N3906
Q2	XSTR-2N3563 NPN S1 R110 LOW PWR	1272-0022	Fairchild	2N3563
Q3	XSTR-2N3563 NPN S1 R110 LOW PWR	1272-0022	Fairchild	2N3563
Q4	XSTR-2N3563 NPN S1 R110 LOW PWR	1272-0022	Fairchild	2N3563
Q5	XSTR-2N3563 NPN S1 R110 LOW PWR	1272-0022	Fairchild	2N3563
Q6	XSTR-2N3563 NPN S1 R110 LOW PWR	1272-0022	Fairchild	2N3563
Q7	XSTR-2N3563 NPN S1 R110 LOW PWR	1272-0022	Fairchild	2N3563
Q8	XSTR-2N3563 NPN S1 R110 LOW PWR	1272-0022	Fairchild	2N3563
Q9	XSTR-2N3563 NPN S1 R110 LOW PWR	1272-0022	Fairchild	2N3563
Q10	XSTR-2N3563 NPN S1 R110 LOW PWR	1272-0022	Fairchild	2N3563
Q11	XSTR-2N3563 NPN S1 R110 LOW PWR	1272-0022	Fairchild	2N3563
Q12	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q13	XSTR-2N3906 PNP S1 to 92 LOW PWR/SW	1272-0037	Motorola	2N3906
Q14	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q15	XSTR-2N3563 NPN S1 R110 LOW PWR	1272-0022	Fairchild	2N3563
Q16	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q17	XSTR-2N5089 NPN S1 to 92 LOW PWR	1272-0031	Motorola	2N5089
Q18	XSTR-2N3906 PNP S1 to 92 LOW PWR/SW	1272-0037	Motorola	2N3906

Table 6-14. 100 Hz Synth/Fixed Divider, (4200) Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
Q19	XSTR-2N3906 PNP S1 to 92 LOW PWR/SW	1272-0037	Motorola	2N3906
Q20	XSTR-2N3906 PNP S1 to 92 LOW PWR/SW	1272-0037	Motorola	2N3906
Q21	XSTR-2N4258 PNP S1 R110 LOW PWR/SW	1272-0097	Fairchild	2N4258
	RESISTOR			
R1	RES-51 OHM 5% 1/4W CC	1066-5105	A. Bradley	CB5105
R2	RES-15K 5% 1/4W CC	1066-1535	A. Bradley	CB1535
R3	RES-82K 5% 1/4W CC	1066-8235	A. Bradley	CB8235
R4	RES-30K 5% 1/4W CC	1066-3035	A. Bradley	CB3035
R5	RES-20K 5% 1/4W CC	1066-2035	A. Bradley	CB2035
R6	RES-51K 5% 1/4W CC	1066-5135	A. Bradley	CB5135
R7	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R8	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R9	RES-2.4K 5% 1/4W CC	1066-2425	A. Bradley	CB2425
R10	RES-11K 5% 1/4W CC	1066-1135	A. Bradley	CB1135
R11	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R12	RES-51 OHM 5% 1/4W CC	1066-5105	A. Bradley	CB5105
R13	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R14	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R15	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R16	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R17	RES-750 OHM 5% 1/4W CC	1066-7515	A. Bradley	CB7515
R18	RES-3K 5% 1/4W CC	1066-3025	A. Bradley	CB3025
R19	RES-51K 5% 1/4W CC	1066-5135	A. Bradley	CB5135
R20	RES-6.2K 5% 1/4W CC	1066-6225	A. Bradley	CB6225
R21	RES-240 OHM 5% 1/4W CC	1066-2415	A. Bradley	CB2415
R22	RES-390 OHM 5% 1/4W CC	1066-3915	A. Bradley	CB3915
R23	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R24	RES-240 OHM 5% 1/4W CC	1066-2415	A. Bradley	CB2415
R25	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R26	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R27	RES-620 OHM 5% 1/4W CC	1066-6215	A. Bradley	CB6215
R28	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R29	RES-240 OHM 5% 1/4W CC	1066-2415	A. Bradley	CB2415
R30	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R31	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R32	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R33	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R34	RES-240 OHM 5% 1/4W CC	1066-2415	A. Bradley	CB2415
R35	RES-51 OHM 5% 1/4W CC	1066-5105	A. Bradley	CB5105

Table 6-14. 100 Hz Synth/Fixed Divider, (4200) Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R36	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R37	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R38	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R39	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R40	RES-5.1 OHM 5% 1/4W CC	1066-0002	A. Bradley	CB51G5
R41	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R42	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R43	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R44	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R45	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R46	RES-620 OHM 5% 1/4W CC	1066-6215	A. Bradley	CB6215
R47	RES-51 OHM 5% 1/4W CC	1066-5105	A. Bradley	CB5105
R48	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R49	RES-51 OHM 5% 1/4W CC	1066-5105	A. Bradley	CB5105
R50	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R51	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R52	RES-750 OHM 5% 1/4W CC	1066-7515	A. Bradley	CB7515
R53	RES-5.1 OHM 5% 1/4W CC	1066-0002	A. Bradley	CB51G5
R54	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R55	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R56	RES-750 OHM 5% 1/4W CC	1066-7515	A. Bradley	CB7515
R57	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R58	RES-5.1 OHM 5% 1/4W CC	1066-0002	A. Bradley	CB51G5
R59	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R60	POT-100K 10% 3/4W 15T CERMET TRMR	1215-0006	Beckman	89WR
R61	POT-10K 10K 3/4W 15T CERMET TRMR	1215-0014	Helitrim	89WR10K
R62	RES-22.6K 1% 100PPM FILM	1074-1056	CAT.LIST	55-100
R63	RES-7.5K 5% 1/4W CC	1066-7525	A. Bradley	CB7525
R64	RES-33K 5% 1/4W CC	1066-3335	A. Bradley	CB3335
R65	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R66	RES-14.7K 1% 150PPM FILM	1074-1020	CAT.LIST	55-100
R67	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R68	Not used			
R69	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R70	RES-75 OHM 5% 1/4W CC	1066-7505	A. Bradley	CB7505
R71	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R72	RES-750 OHM 5% 1/4W CC	1066-7515	A. Bradley	CB7515
R73	RES-360 OHM 5% 1/4W CC	1066-3615	A. Bradley	CB3615
R74	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R75	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015

Table 6-14. 100 Hz Synth/Fixed Divider, (4200) Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R76	RES-51 OHM 5% 1/4W CC	1066-5105	A. Bradley	CB5105
R77	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R78	RES-5.1K 15% 1/4W CC	1066-5125	A. Bradley	CB5125
R79	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R80	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R81	RES-750 OHM 5% 1/4W CC	1066-7515	A. Bradley	CB7515
R82	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R83	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R84	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R85	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R86	RES-20K OHM 5% 1/4W CC	1066-2035	A. Bradley	CB2035
R87	POT-5K 20% 1/2W 1T CERMET TRMR	1203-0071	Beckman	91AR5K
R88	RES-3.9K 5% 1/4W CC	1066-3925	A. Bradley	CB3925
R89	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R90	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R91	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R92	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R93	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R94	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R95	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R96	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R97	RES-510 OHM 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R98	RES-5.1K 1/4W CC	1055-5125	A. Bradley	CB5125
R99	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R100	RES-20K 1% 100PPM FILM	1075-0096	CAT.LIST	55-100
R101	RES-4.02K 1% 100PPM FILM	1075-0094	CAT.LIST	55-100
R102	RES-10K 1% 100PPM FILM	1075-0009	CAT.LIST	55-100
R103	RES-10K 1% 100PPM FILM	1075-0009	CAT.LIST	55-100
R104	RES-10K 1% 100PPM FILM	1075-0009	CAT.LIST	55-100
R105	RES-4.53K 1% 100PPM FILM	1075-0053	CAT.LIST	55-100
R106	RES-3K 5% 1/4W CC	1066-3025	A. Bradley	CB3025
R107	RES-27.4 1% 150PPM FILM	1074-1004	CAT.LIST	55-100
R108	RES-4.02K 1% 100PPM FILM	1075-0094	CAT.LIST	55-100
R109	RES-4.02K 1% 100PPM FILM	1075-0094	CAT.LIST	55-100
R110	RES-2.7K 5% 1/4W CC	1066-2725	A. Bradley	CB2725
R111	RES-100K 5% 1/4W CC	1066-1045	A. Bradley	CB1045
R112	POT-100K 20% 1/2W 1T CERMET TRMR	1215-0046	Beckman	91AR100K

Table 6-14. 100 Hz Synth/Fixed Divider, (4200) Parts List
(Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R113	RES-2.37K 1% 100PPM FILM	1075-0055	Dale	MFF-1/8
R114	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R115	RES-16.9K 1% 100PPM FILM	1075-0059	CAT.LIST	55-100
R116	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R117	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R118	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R119	RES-2.49K 11% 100PPM FILM	1075-0027	CAT.LIST	55-100
R120	RES-16.9K 1% 100PPM FILM	1075-0059	CAT.LIST	55-100
R121	RES-2.49K 1% 100PPM FILM	1075-0027	CAT.LIST	55-100
R122	RES-2.37K 1% 100PPM FILM	1075-0055	Dale	MFF-1/8
R123	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R124	RES-20K 1% 100PPM FILM	1075-0096	CAT.LIST	55-100
R125	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R126	RES-12 OHM 5% 1/4W CC	1066-1205	A. Bradley	CB1205
R127	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R128	RES-130 OHM 5% 1/4W CC	1066-1315	A. Bradley	CB1315
R129	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R130	RES-10K 1% 100PPM FILM	1075-0009	CAT.LIST	55-100
R131	POT-500 OHM 20% 1/2W 1T CERMET TRMR	1215-0042	Beckman	91AR500
R132	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R133	RES-511K 1% 100PPM FILM	1075-0156	CAT.LIST	55-100
R134	RES-511K 1% 100PPM FILM	1075-0156	CAT.LIST	55-100
R135	RES-750 OHM 5% 1/4W CC	1066-7515	A. Bradley	CB7515
R136	RES-3.01K 1% 100PPM FILM	1075-0127	CAT.LIST	55-100
R137	POT-2K 10% 3/4W 15T CERMET TRMR	1215-0015	Beckman	89WR2K
R138	RES-6.49K 1% 100PPM FILM	1075-0021	Use Source Appr List	CAT.55-100
R139	THMS-100 OHM 10% 7MW AXL/RDL DISC	1253-0004	Veco	21E23
R140	Not used			
R141	POT-100K 20% 1/2W 1T CERMET TRMR	1215-0046	Beckman	91AR100K

Table 6-14. 100 Hz Synth/Fixed Divider, (4200) Parts List (Concluded).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	TRANSFORMER			
T1	XFMR-ASSY BIFILAR TORODIAL	1579-0025		
	INTEGRAGED CIRCUIT			
U1	IC-SN74196N	2025-0016	Fairchild	74196C
U2	IC-3130 8 PIN DIP OP AMPL	2025-0269	RCA	CA313E
U3	IC-UA741CP	2025-0067	Texas Instrments	UA741CP
U4	IC-3130 8 PIN DIP OP AMPL	2025-0269	RCA	CA3130E
U5	IC-UA741CP	2025-0067	Texas Instruments	UA741CP
U6	IC-TL082 8 PIN DIP BIFET OP AMPL	2025-0192	Texas Instruments	TL082CP

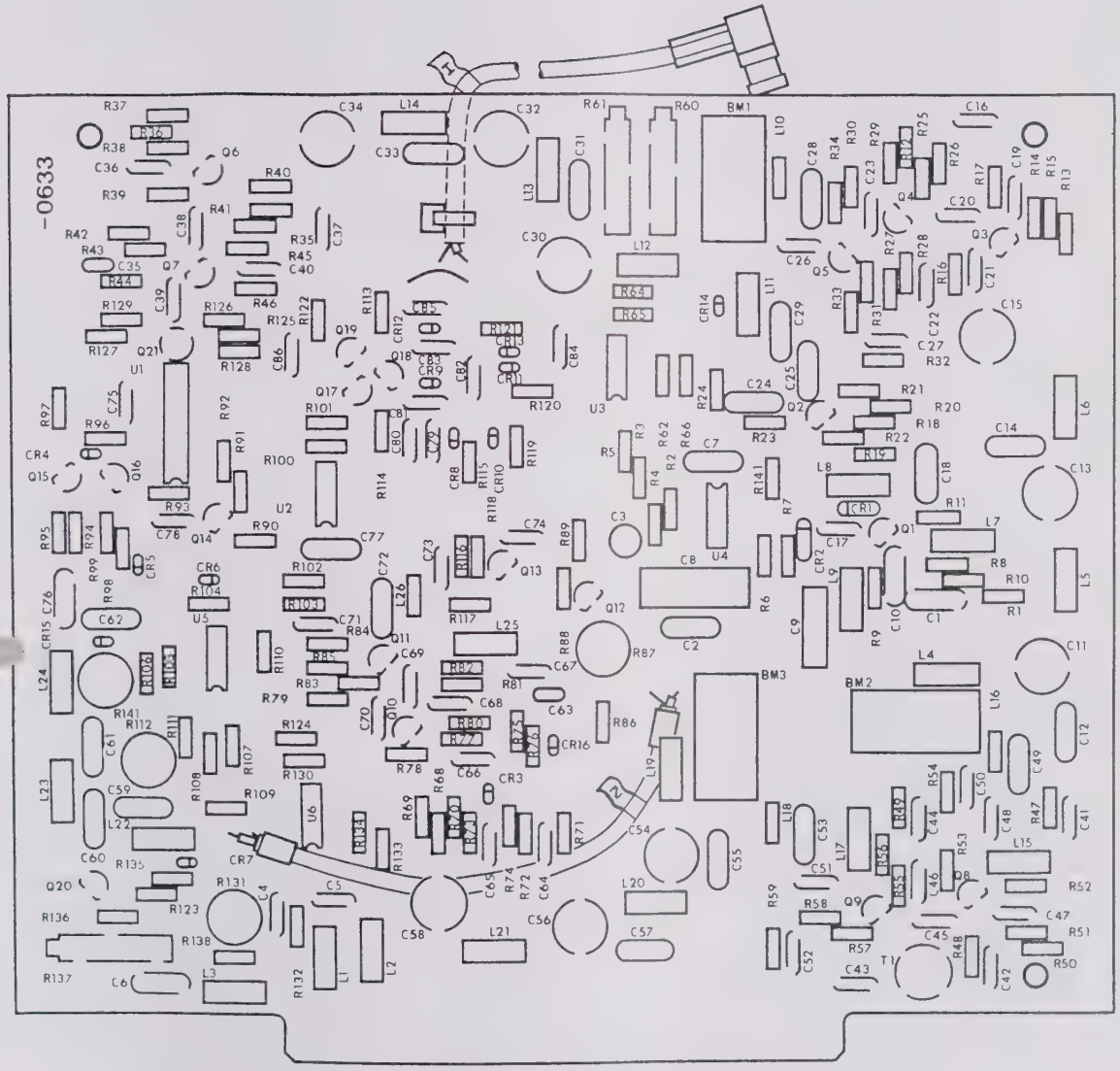


Figure 6-30. 100 Hz Synthesizer (4200) Component Location.

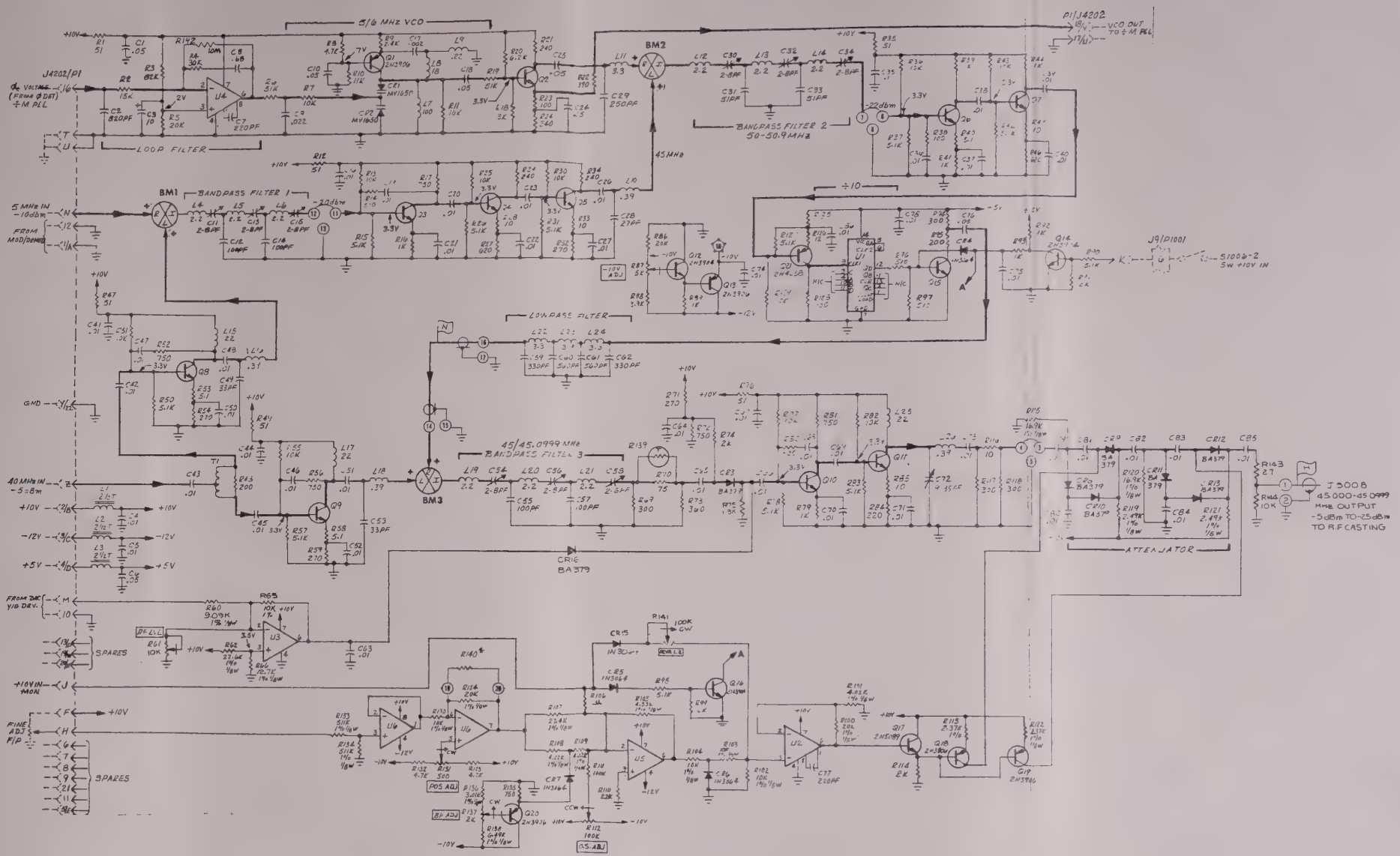


Figure 6-31. 100 Hz Synthesizer (4200) Schematic Diagram.

CE-4000

Table 6-15. Reference Frequency Generator (4300), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C22	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Ind	CSR100161
C23	CAP-330PF 5% 500V DIP MICA	1002-0032	Elmenco	DM15F331J
C24	CAP-100PF 5% 500V DIP MICA	1002-0011	Elmenco	DM15F101J
C25	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C26	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C27	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C28	CAP-150PF 1% 500V DIP MICA	1002-0004	Elmenco	DM15F151F
C29	CAP-91PF 5% 500V DIP MICA	1002-0027	Elmenco	DM15F681J
C30	CAP-680PF 5% 300V DIP MICA	1002-0022	Elmenco	DM15F681J
C31	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C32	CAP-15-60PF 200V N1500 V MT CER TRMR	1001-0017	Tusonix	583011F1560
C33	CAP-360PF 5% 500V DIP MICA	1002-0040	Elmenco	
C34	CAP-560PF 5% 300V DIP MICA	1002-0037	Sangamo	D155F561
C35	CAP-680PF 5% 300V DIP MICA	1002-0022	Elmenco	DM15F681J
C36	CAP-9-35PF 200V N650 V MT CER TRMR	1001-0006	Erie	CV31D350
C37	CAP-91PF 5% 500V DIP MICA	1002-0027	Elmenco	DM15F910J
C38	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C39	CAP-82PF 5% 500V DIP MICA	1002-0020	Elmenco	DM15E820J
C40	CAP-15PF 5% 500V DIP MICA	1002-0001	Elmenco	DM15C150J
C41	CAP-43PF 5% 500V DIP MICA	1002-0046	Sangamo	D155E430
C42	CAP-39PF 2% 500V DIP MICA	1002-0054	Elmenco	DM15E390G
C43	CAP-15-60PF 200V N1500 V MT CER TRMR	1001-0017	Tusonix	5835512Y5U 103Z

CE-4000

Table 6-15. Reference Frequency Generator (4300), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C44	CAP-10PF 5% 500V DIP MICA	1002-0016	Elmenco	DM15C100J
C45	CAP-5.5-18PF 350V NPO V MT CER TRMR	1001-0008	Erie	CV31A130
C46	CAP-91PF 5% 500V DIP MICA	1002-0027	Elmenco	DM15F9110J
C47	CAP-10PF 5% 500V DIP MICA	1002-0016	Elmenco	DM15G100J
C48	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C49	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011AZ8
C50	CAP-20PF 5% 500V DIP MICA	1002-0060	Elmenco	DM155E200J
C51	CAP-220PF 5% 100V NPO MINTR CER	1005-0134		
C52	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011AZ8
C53	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C54	CAP-0.5PF 0.25PF 500V NPO CER TUB	1005-0114	Tusonix	301000C0K0 508C
C55	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	301000C0KU 103Z
C56	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C57	CAP-20PF 5% 500V DIP MICA	1002-0060	Elmenco	DM15E200J
C58	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C59	CAP-18PF 5% 500V DIP MICA	1002-0014	Elmenco	DM15C180J
C60	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C61	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011AZ8
C62	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C63	CAP-20PF 5% 500V DIP MICA	1002-0060	Elmenco	DM15E200J
C64	CAP-2.79PF 10% 100V NPO MINTR CER	1005-0124	Tusonix	8101100C0J0 279C
C65	CAP-100UF -10+75% 16V RDL MET-MYLAR	1013-0033	Callins Industries	CSR100161

CE-4000

Table 6-15. Reference Frequency Generator (4300), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C66	CAP-0.22UF 10% 100V RDL MET-MYLAR	1008-0091	Electrocube	232A15224K
C67	CAP-6.8UF 10% 35V RDL TANT	1011-0002	Dickson	D6R8GS1B35K
C68	CAP-0.22UF 10% 100V RDL MET-MYLAR	1008-0091	Electrocube	232A15224K
C69	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Callins Industries	CRS1501
C70	CAP-470PF 5% 500V DIP MICA	1002-0035	Sangamo	D155F471
C71	CAP-470PF 5% 500V DIP MICA	1002-0025	Elmenco	DM15E750J
C72	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C73	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C74	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C75	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25
C76	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Callins Industries	CRS1501
C77	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C78	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C79	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
	CAPACITOR			
CR1	DIO-1N4733A SI ZENER DO41 5.1V 5% 1W	1281-0031	Motorola	1N4733A
CR2	DIO-LT EMIT RED 1.6V W ANG T1	1281-0137	HP	5082-4484
CR3	DIO-LT EMIT RED 1.6V W ANG T1	1281-0137	HP	5082-4484
CR4	DIO-LT EMIT RED 1.6V W ANG T1	1281-0137	HP	5082-4484

CE-4000

Table 6-15. Reference Frequency Generator (4300), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	INDUCTOR			
L1	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VX20020/4B
L2	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
L3	CH-33UH 5% RF MLD AXL 0.16DX0.38L	1585-0022	Delevan	1537-56
L4	CH-33UH 5% RF MLD AXL 0.16DX0.38L	1585-0022	Delevan	1537-56
L5	CH-0.68UH 10% RF MLD AXL 0.16DX0.38L	1585-0024	Delevan	1537-08
L6	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
L7	CH-3.3UH 10% RF MLD AXL 0.16DX0.38L	1585-0037	Delevan	1537-24
L8	CH-2.2UH 10% RF MLD AXL 0.16DX0.38L	1585-0013	Delevan	1537-20
L9	CH-0.56UH 10% RF MLD AXL 0.16DX0.38L	1585-0090	Delevan	1537-07
L10	CH-0.22UH 20% RF MLD AXL 0.16DX0.38L	1585-0039	Delevan	1537-02
L11	CH-0.22UH 20% RF MLD AXL 0.16DX0.38L	1585-0039	Delevan	1537-02
L12	CH-3.9UH 10% RF MLD AXL 0.16DX0.38L	1585-0039	Delevan	1537-02
L13	CH-1UH 10% RF MLD AXL 0.16DX0.38L	1585-0027	Delevan	1537-12
L14	CH-0.12UH 10% RF MLD AXL 0.10DX0.25L	1585-0068	Delevan	1025-96
L15	CH-1.8UH 10% RF MLD AXL 0.16DX0.38L	1585-0072	Delevan	1537-18
L16	CH-0.68UH 10% RF MLD AXL 0.16DX0.38L	1585-0024	Delevan	1537-08
L17	CH-0.12UH 10% RF MLD AXL 0.10DX0.25L	1585-0068	Delevan	1025-96
L18	COIL 4 TURN 31 MHz	1596-0110	TRW	C/E DWG
L19	CH-0.12UH 10% RF MLD AXL 0.10DX0.25L	1585-0068	Delevan	1025-96
L20	CH-0.12UH 10% RF MLD AXL 0.10DX0.25L	1585-0068	Delevan	1025-96
L21	ASSY-COIL 0.064 UH RF	1585-5802	Delevan	1537-00
L22	CH-0.15UH 20% RF MLD AXL 0.16DX0.38L	1585-0048	Delevan	

CE-4000

Table 6-15. Reference Frequency Generator (4300), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
L23	CH-0.047X0.138X0.188 FERRITE BEAD 4B	1586-0004	Ferroxcube	5659063/4B
L24	CH-4700UH 5% RF MLD AXL 0.240X0.74L	1583-0006	Delevan	2500-60
L25	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
	TRANSISTOR			
Q1	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q2	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q3	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q4	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q5	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q6	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q7	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q8	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q9	XSTR-2N5179 NPN SI TO 72 LOW PWR (MOTA)	1272-0060	Motorola	2N5179
Q10	XSTR-2N5179 NPN SI TO 72 LOW PWR (MOTA)	1272-0060	Motorola	2N5179
Q11	XSTR NE73432E NPN SI TO 92 LOW PWR	1272-0112	Nippon	NE73432E
Q12	XSTR-2N5179 NPN SI TO 72 LOW PWR (MOTA)	1272-0060	Motorola	2N5179
Q13	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q14	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q15	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q16	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904

CE-4000

Table 6-15. Reference Frequency Generator (4300), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	RESISTOR			
R1	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R2	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R3	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R4	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R5	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R6	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R7	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R8	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R9	RES-3.3K 5% 1/4W CC	1066-3325	A. Bradley	CB3325
R10	RES-3.3K 5% 1/4W CC	1066-3325	A. Bradley	CB3325
R11	RES-5.6K 5% 1/4W CC	1066-5625	A. Bradley	CB5625
R12	RES-5.6K 5% 1/4W CC	1066-5625	A. Bradley	CB5625
R13	RES-330 OHM 5% 1/4W CC	1066-3315	A. Bradley	CB3315
R14	RES-330 OHM 5% 1/4W CC	1066-3315	A. Bradley	CB3315
R15	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB3315
R16	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R17	RES-3.3K 5% 1/4W CC	1066-3325	A. Bradley	CB3325
R18	RES-5.6K 5% 1/4W CC	1066-5625	A. Bradley	CB5625
R19	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R20	RES-330 OHM 5% 1/4W CC	1066-3315	A. Bradley	CB3315
R21	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R22	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R23	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R24	RES-2.7K 5% 1/4W CC	1066-2725	A. Bradley	CB2725
R25	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R26	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R27	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R28	RES-62 OHM 5% 1/4W CC	1066-6205	A. Bradley	CB6205
R29	RES-12K 5% 1/4W CC	1066-1235	A. Bradley	CB1235
R30	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R31	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R32	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R33	RES-820 OHM 5% 1/4W CC	1066-8215	A. Bradley	EB8215
R34	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R35	RES-47 OHM 5% 1/4W CC	1066-4705	A. Bradley	CB4705
R36	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R37	RES-47 OHM 5% 1/4W CC	1066-4705	A. Bradley	CB4705
R38	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R39	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R40	POT-20K 20% 1/2W 1T CERMET TRMR	1215-0044	Beckman	91AR20K
R41	RES-5.6K 5% 1/4W CC	1066-5625	A. Bradley	CB5625
R42	RES-430 OHM 5% 1/4W CC	1066-4315	A. Bradley	CB4315
R43	RES-20 OHM 5% 1/4W CC	1066-2005	A. Bradley	CB2005
R44	RES-3.3K 5% 1/4W CC	1066-3325	A. Bradley	CB3325

CE-4000

Table 6-15. Reference Frequency Generator (4300), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R45	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R46	RES-20 OHM 5% 1/4W CC	1066-2005	A. Bradley	CB2005
R47	RES-39 OHM 5% 1/4W CC	1066-3905	A. Bradley	BB3905
R48	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R49	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R50	RES-39 OHM 5% 1/8W CC	1065-3905	A. Bradley	BB3905
R51	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R52	RES-6.8K 5% 1/4W CC	1066-6825	A. Bradley	CB6825
R53	RES-2.7K 5% 1/4W CC	1066-2725	A. Bradley	CB2725
R54	RES-39 OHM 5% 1/8W CC	1065-3905	A. Bradley	BB3905
R55	RES-6.8K 5% 1/4W CC	1066-6825	A. Bradley	CB6825
R56	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R57	RES-180 OHM 5% 1/4W CC	1066-1815	A. Bradley	CB1815
R58	RES-470 OHM 5% 1/4W CC	1066-4715	A. Bradley	CB4715
R59	RES-39 OHM 5% 1/4W CC	1066-3905	A. Bradley	BB3905
R60	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4724
R61	RES-150 OHM 5% 1/4W CC	1066-1515	A. Bradley	CB1515
R62	RES-30 OHM 5% 1/4W CC	1066-3905	A. Bradley	BB3905
R63	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R64	RES-39 OHM 5% 1/8W CC	1065-3905	A. Bradley	BB3905
R65	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R66	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R67	RES-3K 5% 1/4W CC	1066-3025	A. Bradley	CB3025
R68	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R69	RES-470 OHM 5% 1/4W CC	1066-4715	A. Bradley	CB4715
R70	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R71	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R72	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R73	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R74	RES-390 OHM 5% 1/4W CC	1066-3915	A. Bradley	CB3915
R75	RES-13K 5% 1/4W CC	1066-1335	A. Bradley	CB1335
R76	RES-36K 5% 1/4W CC	1066-3635	A. Bradley	CB3635
R77	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R78	RES-150 OHM 5% 1/4W CC	1066-1515	A. Bradley	CB1515
R79	RES-820 OHM 5% 1/4W CC	1066-8215	A. Bradley	EB8215
R80	RES-3K 5% 1/4W CC	1066-3025	A. Bradley	CB3025
R81	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R82	RES 1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R83	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015

CE-4000

Table 6-15. Reference Frequency Generator (4300), Parts List (Concluded).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	INTEGRATED CIRCUIT			
U1	IC-SN74LS90N DECADE COUNTER	2025-0113	Texas Instruments	SN74LS90N
U2	IC-SN74LS90N DECADE COUNTER	2025-0113	Texas Instruments	SN74LS90N
U3	IC-SN74LS90N DECADE COUNTER	2025-0113	Texas Instruments	SN74LS90N
U4	IC-SN74LS90N DECADE COUNTER	2025-0113	Texas Instruments	SN74LS90N
U5	IC-SN74LS00N TTL NAND GATES	2025-0114	Texas Instruments	SN74LS00N
	CRYSTAL			
Y1	OSC-TCXO 10.0 MHz	2001-0015		

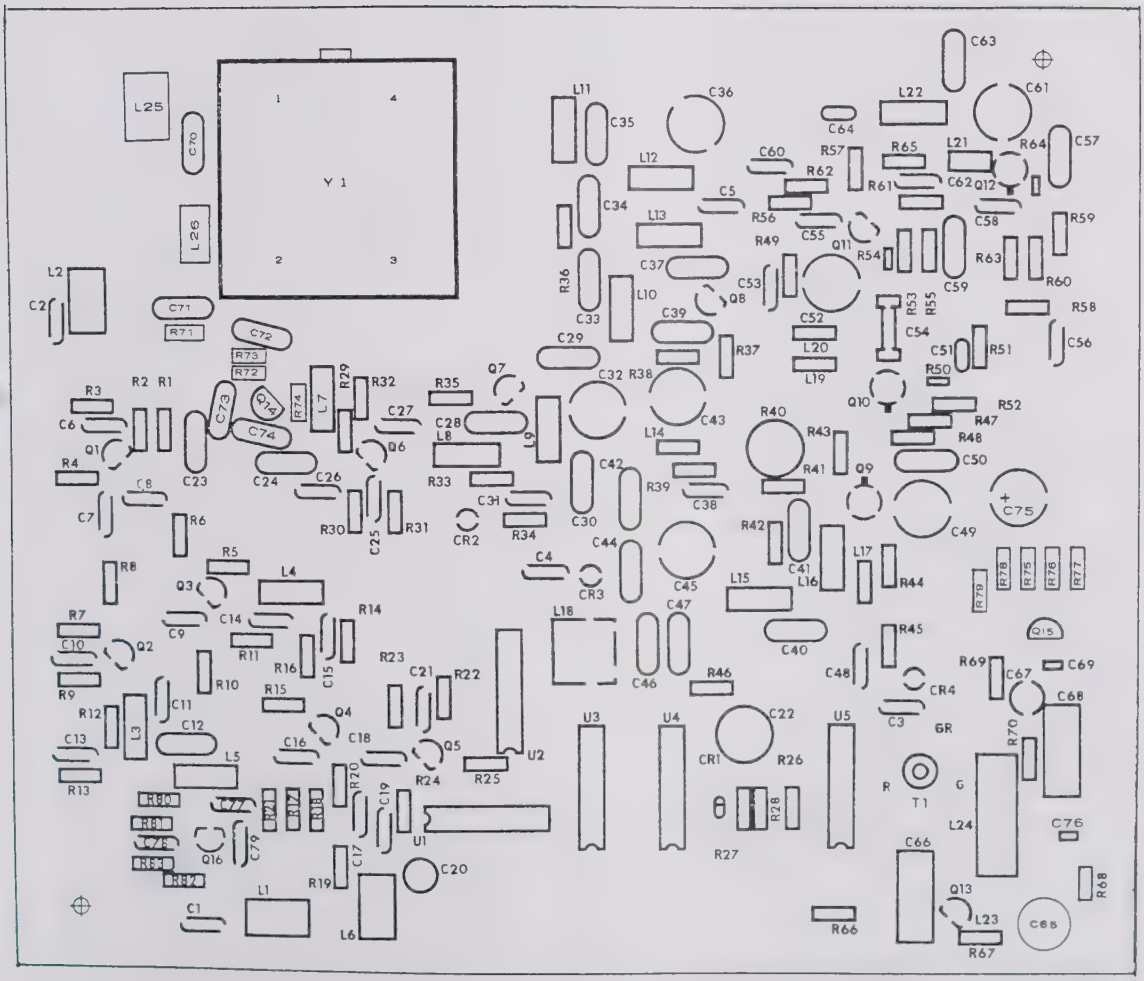


Figure 6-32. Reference Frequency Generator (4300) Component Location.

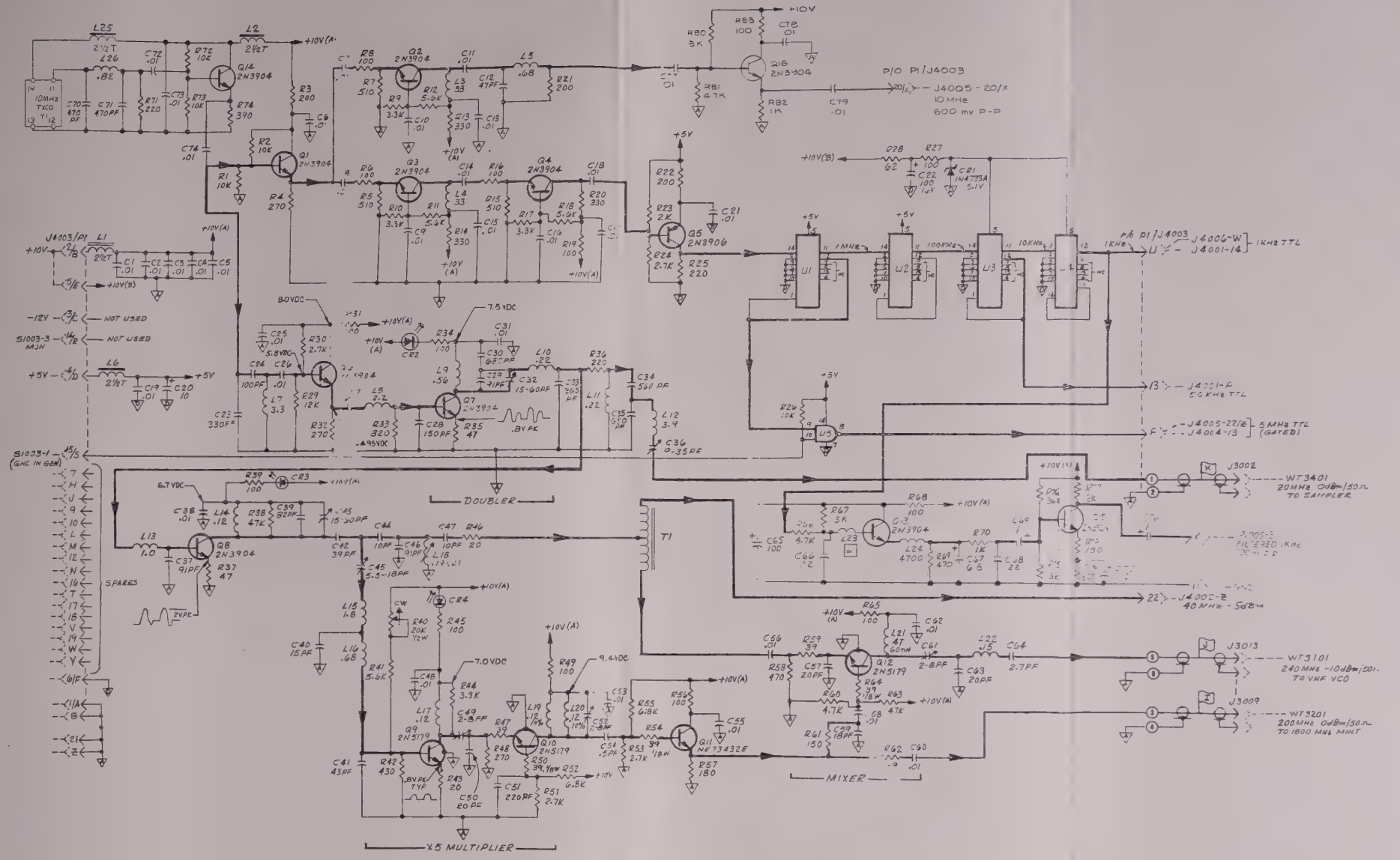


Figure 6-33. Reference Frequency Generator (4300) Schematic Diagram.

CE-4000

Table 6-16. Reference Frequency Generator (4300) (OP 04) Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
4300	PCB ASSY-REF FREQ GEN	7001-0797		
	CAPACITOR			
C1	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C2	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C3	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C4	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C5	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C6	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C7	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C8	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C9	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C10	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C11	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C12	CAP-47PF 5% 500V DIP MICA	1002-0012	Elmenco	DM155E4703
C13	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C14	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C15	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C16	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C17	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C18	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C19	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C20	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap.	10PC25
C21	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z

CE-4000

Table 6-16. Reference Frequency Generator (4300),) (OP-04) Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C22	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Ind	CSR100161
C23	CAP-330PF 5% 500V DIP MICA	1002-0032	Elmenco	DM15F331J
C24	CAP-100PF 5% 500V DIP MICA	1002-0011	Elmenco	DM15F101J
C25	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C26	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C27	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C28	CAP-150PF 1% 500V DIP MICA	1002-0004	Elmenco	DM15F151F
C29	CAP-91PF 5% 500V DIP MICA	1002-0027	Elmenco	DM15F681J
C30	CAP-680PF 5% 300V DIP MICA	1002-0022	Elmenco	DM15F681J
C31	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C32	CAP-15-60PF 200V N1500 V MT CER TRMR	1001-0017	Tusonix	583011F1560
C33	CAP-360PF 5% 500V DIP MICA	1002-0040	Elmenco	
C34	CAP-560PF 5% 300V DIP MICA	1002-0037	Sangamo	D155F561
C35	CAP-680PF 5% 300V DIP MICA	1002-0022	Elmenco	DM15F681J
C36	CAP-9-35PF 200V N650 V MT CER TRMR	1001-0006	Erie	CV31D350
C37	CAP-91PF 5% 500V DIP MICA	1002-0027	Elmenco	DM15F910J
C38	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C39	CAP-82PF 5% 500V DIP MICA	1002-0020	Elmenco	DM15E820J
C40	CAP-15PF 5% 500V DIP MICA	1002-0001	Elmenco	DM15C150J
C41	CAP-43PF 5% 500V DIP MICA	1002-0046	Sangamo	D155E430
C42	CAP-39PF 2% 500V DIP MICA	1002-0054	Elmenco	DM15E390G
C43	CAP-15-60PF 200V N1500 V MT CER TRMR	1001-0017	Tusonix	5835512Y5U 103Z

Table 6-16. Reference Frequency Generator (4300) (OP-04) Parts List. (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C44	CAP-10PF 5% 500V DIP MICA	1002-0016	Elmenco	DM15C100J
C45	CAP-5.5-18PF 350V NPO V MT CER TRMR	1001-0008	Erie	CV31A130
C46	CAP-91PF 5% 500V DIP MICA	1002-0027	Elmenco	DM15F9110J
C47	CAP-10PF 5% 500V DIP MICA	1002-0016	Elmenco	DM15G100J
C48	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C49	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011AZ8
C50	CAP-20PF 5% 500V DIP MICA	1002-0060	Elmenco	DM155E200J
C51	CAP-220PF 5% 100V NPO MINTR CER	1005-0134		
C52	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011AZ8
C53	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C54	CAP-0.5PF 0.25PF 500V NPO CER TUB	1005-0114	Tusonix	301000C0K0 508C
C55	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	301000C0KU 103Z
C56	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C57	CAP-20PF 5% 500V DIP MICA	1002-0060	Elmenco	DM15E200J
C58	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C59	CAP-18PF 5% 500V DIP MICA	1002-0014	Elmenco	DM15C180J
C60	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C61	CAP-2-8PF 350V NPO V MT CER TRMR	1001-0004	Tusonix	538011AZ8
C62	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C63	CAP-20PF 5% 500V DIP MICA	1002-0060	Elmenco	DM15E200J
C64	CAP-2.79PF 10% 100V NPO MINTR CER	1005-0124	Tusonix	8101100C0J0 279C
C65	CAP-100UF -10+75% 16V RDL MET-MYLAR	1013-0033	Callins Industries	CSR100161

CE-4000

Table 6-16. Reference Frequency Generator (4300) (OP-04) Parts List. (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C66	CAP-0.22UF 10% 100V RDL MET-MYLAR	1008-0091	Electrocube	232A15224K
C67	CAP-6.8UF 10% 35V RDL TANT	1011-0002	Dickson	D6R8GS1B35K
C68	CAP-0.22UF 10% 100V RDL MET-MYLAR	1008-0091	Electrocube	232A15224K
C69	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Callins Industries	CRS1501
C70	CAP-470PF 5% 500V DIP MICA	1002-0035	Sangamo	D155F471
C71	CAP-470PF 5% 500V DIP MICA	1002-0025	Elmenco	DM15E750J
C72	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C73	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C74	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C75	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25
C76	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Callins Industries	CRS1501
C77	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C78	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C79	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
	CAPACITOR			
CR1	DIO-1N4733A SI ZENER DO41 5.1V 5% 1W	1281-0031	Motorola	1N4733A
CR2	DIO-LT EMIT RED 1.6V W ANG T1	1281-0137	HP	5082-4484
CR3	DIO-LT EMIT RED 1.6V W ANG T1	1281-0137	HP	5082-4484
CR4	DIO-LT EMIT RED 1.6V W ANG T1	1281-0137	HP	5082-4484

CE-4000

Table 6-16. Reference Frequency Generator (4300) (OP-04) Part List. (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	INDUCTOR			
L1	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VX20020/4B
L2	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
L3	CH-33UH 5% RF MLD AXL 0.16DX0.38L	1585-0022	Delevan	1537-56
L4	CH-33UH 5% RF MLD AXL 0.16DX0.38L	1585-0022	Delevan	1537-56
L5	CH-0.68UH 10% RF MLD AXL 0.16DX0.38L	1585-0024	Delevan	1537-08
L6	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
L7	CH-3.3UH 10% RF MLD AXL 0.16DX0.38L	1585-0037	Delevan	1537-24
L8	CH-2.2UH 10% RF MLD AXL 0.16DX0.38L	1585-0013	Delevan	1537-20
L9	CH-0.56UH 10% RF MLD AXL 0.16DX0.38L	1585-0090	Delevan	1537-07
L10	CH-0.22UH 20% RF MLD AXL 0.16DX0.38L	1585-0039	Delevan	1537-02
L11	CH-0.22UH 20% RF MLD AXL 0.16DX0.38L	1585-0039	Delevan	1537-02
L12	CH-3.9UH 10% RF MLD AXL 0.16DX0.38L	1585-0039	Delevan	1537-02
L13	CH-1UH 10% RF MLD AXL 0.16DX0.38L	1585-0027	Delevan	1537-12
L14	CH-0.12UH 10% RF MLD AXL 0.10DX0.25L	1585-0068	Delevan	1025-96
L15	CH-1.8UH 10% RF MLD AXL 0.16DX0.38L	1585-0072	Delevan	1537-18
L16	CH-0.68UH 10% RF MLD AXL 0.16DX0.38L	1585-0024	Delevan	1537-08
L17	CH-0.12UH 10% RF MLD AXL 0.10DX0.25L	1585-0068	Delevan	1025-96
L18	COIL 4 TURN 31 MHz	1596-0110	TRW	C/E DWG
L19	CH-0.12UH 10% RF MLD AXL 0.10DX0.25L	1585-0068	Delevan	1025-96
L20	CH-0.12UH 10% RF MLD AXL 0.10DX0.25L	1585-0068	Delevan	1025-96
L21	ASSY-COIL 0.064 UH RF	1585-5802	Delevan	
L22	CH-0.15UH 20% RF MLD AXL 0.16DX0.38L	1585-0048	Delevan	1537-00

Table 6-16. Reference Frequency Generator (4300) (OP-04) Parts List. (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
L23	CH-0.047X0.138X0.188 FERRITE BEAD 4B	1586-0004	Ferroxcube	5659063/4B
L24	CH-4700UH 5% RF MLD AXL 0.240X0.74L	1583-0006	Delevan	2500-60
L25	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
	TRANSISTOR			
Q1	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q2	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q3	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q4	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q5	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q6	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q7	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q8	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q9	XSTR-2N5179 NPN SI TO 72 LOW PWR (MOTA)	1272-0060	Motorola	2N5179
Q10	XSTR-2N5179 NPN SI TO 72 LOW PWR (MOTA)	1272-0060	Motorola	2N5179
Q11	XSTR NE73432E NPN SI TO 92 LOW PWR	1272-0112	Nippon	NE73432E
Q12	XSTR-2N5179 NPN SI TO 72 LOW PWR (MOTA)	1272-0060	Motorola	2N5179
Q13	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q14	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q15	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q16	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904

CE-4000

Table 6-16. Reference Frequency Generator (4300) (OP-04) Parts List. (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	RESISTOR			
R1	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R2	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R3	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R4	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R5	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R6	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R7	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R8	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R9	RES-3.3K 5% 1/4W CC	1066-3325	A. Bradley	CB3325
R10	RES-3.3K 5% 1/4W CC	1066-3325	A. Bradley	CB3325
R11	RES-5.6K 5% 1/4W CC	1066-5625	A. Bradley	CB5625
R12	RES-5.6K 5% 1/4W CC	1066-5625	A. Bradley	CB5625
R13	RES-330 OHM 5% 1/4W CC	1066-3315	A. Bradley	CB3315
R14	RES-330 OHM 5% 1/4W CC	1066-3315	A. Bradley	CB3315
R15	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB3315
R16	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R17	RES-3.3K 5% 1/4W CC	1066-3325	A. Bradley	CB3325
R18	RES-5.6K 5% 1/4W CC	1066-5625	A. Bradley	CB5625
R19	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R20	RES-330 OHM 5% 1/4W CC	1066-3315	A. Bradley	CB3315
R21	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R22	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R23	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R24	RES-2.7K 5% 1/4W CC	1066-2725	A. Bradley	CB2725
R25	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R26	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R27	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R28	RES-62 OHM 5% 1/4W CC	1066-6205	A. Bradley	CB6205
R29	RES-12K 5% 1/4W CC	1066-1235	A. Bradley	CB1235
R30	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R31	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R32	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R33	RES-820 OHM 5% 1/4W CC	1066-8215	A. Bradley	EB8215
R34	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R35	RES-47 OHM 5% 1/4W CC	1066-4705	A. Bradley	CB4705
R36	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R37	RES-47 OHM 5% 1/4W CC	1066-4705	A. Bradley	CB4705
R38	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R39	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R40	POT-20K 20% 1/2W 1T CERMET TRMR	1215-0044	Beckman	91AR20K
R41	RES-5.6K 5% 1/4W CC	1066-5625	A. Bradley	CB5625
R42	RES-430 OHM 5% 1/4W CC	1066-4315	A. Bradley	CB4315
R43	RES-20 OHM 5% 1/4W CC	1066-2005	A. Bradley	CB2005
R44	RES-3.3K 5% 1/4W CC	1066-3325	A. Bradley	CB3325

CE-4000

Table 6-16. Reference Frequency Generator (4300) (OP-04) Parts List. (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R45	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R46	RES-20 OHM 5% 1/4W CC	1066-2005	A. Bradley	CB2005
R47	RES-39 OHM 5% 1/4W CC	1066-3905	A. Bradley	BB3905
R48	RES-270 OHM 5% 1/4W CC	1066-2715	A. Bradley	CB2715
R49	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R50	RES-39 OHM 5% 1/8W CC	1065-3905	A. Bradley	BB3905
R51	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R52	RES-6.8K 5% 1/4W CC	1066-6825	A. Bradley	CB6825
R53	RES-2.7K 5% 1/4W CC	1066-2725	A. Bradley	CB2725
R54	RES-39 OHM 5% 1/8W CC	1065-3905	A. Bradley	BB3905
R55	RES-6.8K 5% 1/4W CC	1066-6825	A. Bradley	CB6825
R56	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R57	RES-180 OHM 5% 1/4W CC	1066-1815	A. Bradley	CB1815
R58	RES-470 OHM 5% 1/4W CC	1066-4715	A. Bradley	CB4715
R59	RES-39 OHM 5% 1/4W CC	1066-3905	A. Bradley	BB3905
R60	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4724
R61	RES-150 OHM 5% 1/4W CC	1066-1515	A. Bradley	CB1515
R62	RES-30 OHM 5% 1/4W CC	1066-3905	A. Bradley	BB3905
R63	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R64	RES-39 OHM 5% 1/8W CC	1065-3905	A. Bradley	BB3905
R65	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R66	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R67	RES-3K 5% 1/4W CC	1066-3025	A. Bradley	CB3025
R68	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R69	RES-470 OHM 5% 1/4W CC	1066-4715	A. Bradley	CB4715
R70	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R71	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R72	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R73	RES-1K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R74	RES-390 OHM 5% 1/4W CC	1066-3915	A. Bradley	CB3915
R75	RES-13K 5% 1/4W CC	1066-1335	A. Bradley	CB1335
R76	RES-36K 5% 1/4W CC	1066-3635	A. Bradley	CB3635
R77	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R78	RES-150 OHM 5% 1/4W CC	1066-1515	A. Bradley	CB1515
R79	RES-820 OHM 5% 1/4W CC	1066-8215	A. Bradley	EB8215
R80	RES-3K 5% 1/4W CC	1066-3025	A. Bradley	CB3025
R81	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R82	RES 1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R83	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015

CE-4000

Table 6-16. Reference Frequency Generator (4300) (OP-04) Parts List. (Concluded).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	TRANSOFRMER			
T1	XFMR-ASSY TORDIAL BIFILAR	1579-0027		
	INTEGRATED CIRCUIT			
U1	IC-SN74LS90N DECADE COUNTER	2025-0113	Texas Instruments	SN74LS90N
U2	IC-SN74LS90N DECADE COUNTER	2025-0113	Texas Instruments	SN74LS90N
U3	IC-SN74LS90N DECADE COUNTER	2025-0113	Texas Instruments	SN74LS90N
U4	IC-SN74LS90N DECADE COUNTER	2025-0113	Texas Instruments	SN74LS90N
U5	IC-SN74LS00N TTL NAND GATES	2025-0114	Texas Instruments	SN74LS00N
	CRYSTAL			
Y1	OSC-TCXO 10.0 MHz	2001-0015		

CE-4000

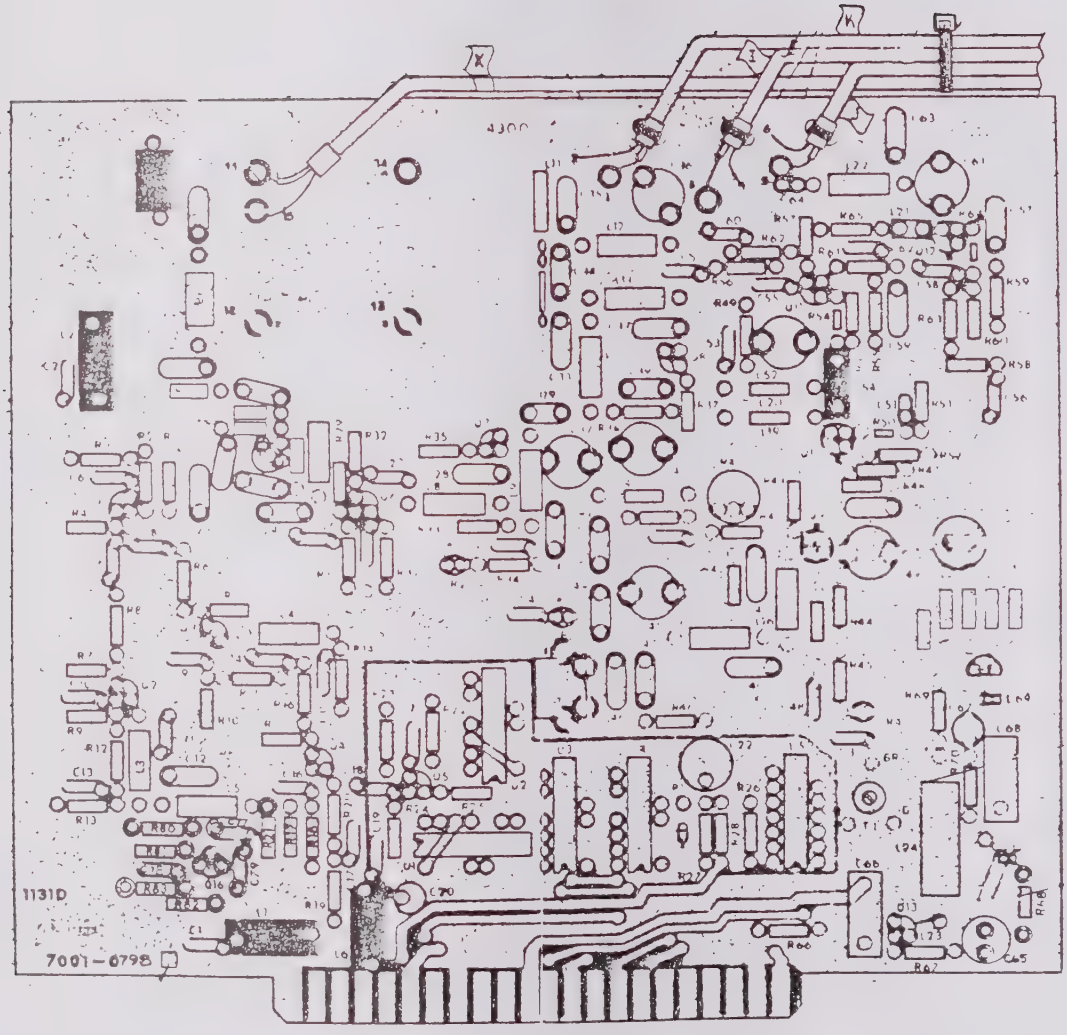


Figure 6-34. Reference Frequency Generator (4300) (OP-04) Component Location.

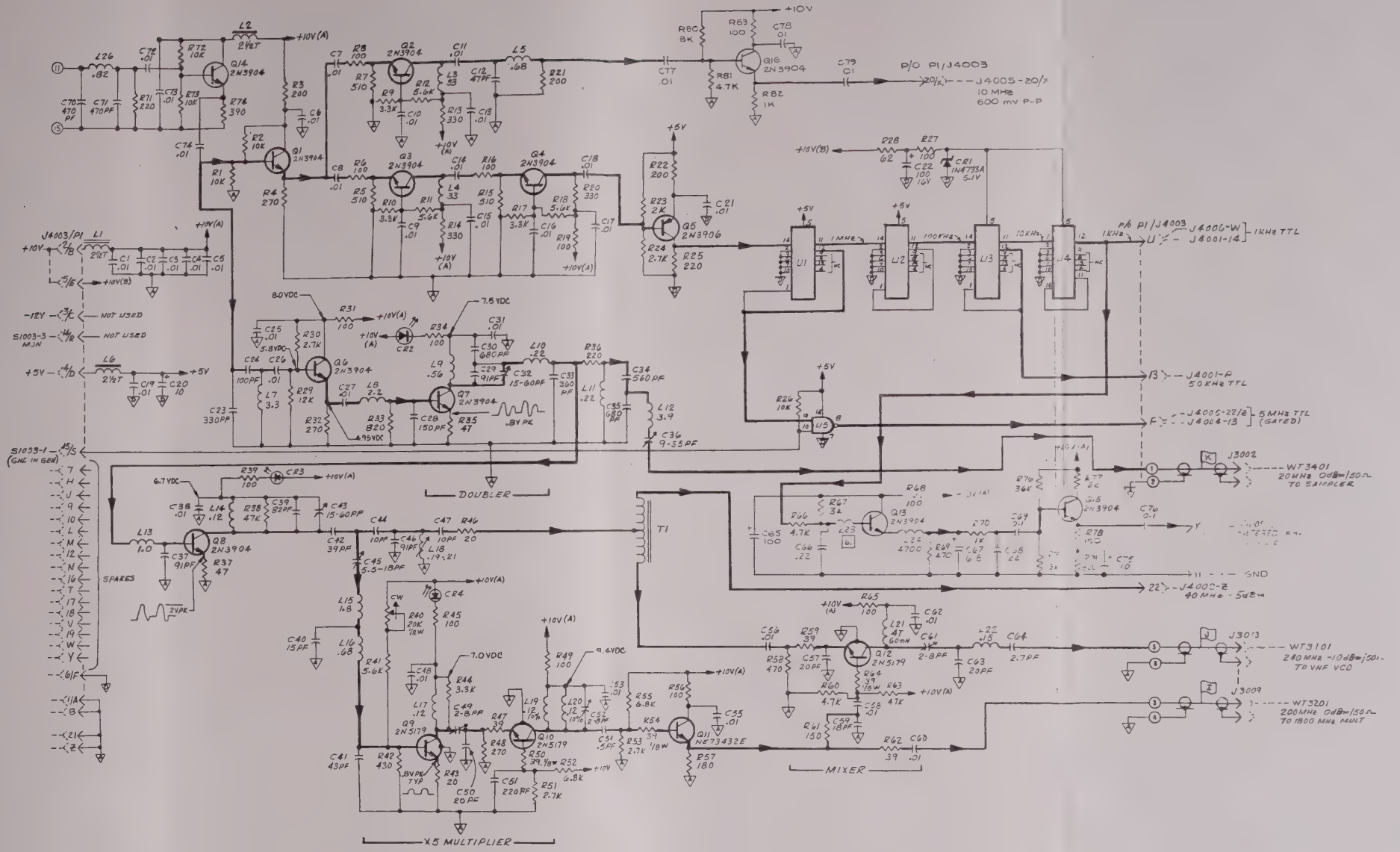


Figure 6-35. Reference Frequency Generator (4300) (OP-04) Schematic Diagram.

CE-4000

Table 6-17. Mod/Demod PCB Assembly (4400), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
4400	PCB ASSY-MOD/DEMOD	7001-0826	Cushman	CE-4000
C1	CAP-1000PF 5% 100V DIP MICA	1002-0015	Elmenco	DM15F102J
C2	Not used			
C3	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25
C4	CAP-390PF 5% 100V NPO MINTR CER	1005-0140	Centre Engineering	200100NP0391J
C5	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Panasonic	ECEA1HV0105
C6	CAP-200PF 5% 500V DIP MICA	1002-0042	Elmenco	DM15F201J
C7	CAP-1100PF 5% 500V DIP MICA	1002-0071	Elmenco	DM19F112J
C8	CAP-300PF 5% 500V DIP MICA	1002-0059	Elmenco	DM15F301J
C9	CAP-100PF 2% 500V DIP MICA	1002-0050	Elmenco	DM15F101G
C10	CAP-100PF 2% 500V DIP MICA	1002-0050	Elmenco	DM15F101G
C11	CAP-24PF 5% 500V DIP MICA	1002-0051	Elmenco	DM15C240J
C12	CAP-56PF 5% 500V DIP MICA	1002-0019	Elmenco	DM15E560J
C13	CAP-33PF 5% 500V DIP MICA	1002-0024	Elmenco	DM15E220J
C14	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C15	CAP-0.47UF 10% 100V AXL MET-MYLAR	1008-0038	Electrocube	230B1B474K
C16	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C17	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15E501J
C18	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15E501J
C20	CAP-430PF 5% 500V DIP MICA	1002-0034	Capco	MME.022MF100V 1%
C21	CAP-2UF 10% 100V AXL MET-MYLAR	1008-0063	Elmenco	DM15F201J
C22	Not used.			

CE-4000

Table 6-17. Mod/Demod PCB Assembly (4400), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C23	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	81210505651 104M
C24	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25
C26	CAP-180PF 5% 500V DIP MICA	1002-0005	Nichicon	35UKB10M
C27	CAP-82PF 5% 500V DIP MICA	1002-0020	Elmenco	DM15F251J
C28	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15E510J
C29	CAP-100UF +100-30% 16V RDL NP ELCTLT	1013-0029	Elpac	ZA-100V
C30	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Panasonic	ECEA1HV010S
C31	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C32	CAP-5PF 0.5PF 500V DIP MICA	1002-0028	Elmenco	DM15C050D
C33	Not used.			
C34	CAP-47UF 10% 6V AXL TANT	1011-0005	Sprague	150D225X90 15B2
C35	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Panasonic	ECEA1HV010S
C36	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Ilinois Cap	10PC25
C37	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C38	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5US 103Z
C39	CAP-0.01UF +80-20% 25V 5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C40	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Panasonic	ECEA1CV101S
C41	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C42	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C43	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C44	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Panasonic	ECEA1CV101S
C45	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103A
C46	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z

Table 6-17. Mod/Demod PCB Assembly (4400), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C47	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C48	CAP-470PF 5% 500V DIP MICA	1002-0035	Sangamo	D155F471
C49	CAP-33PF 5% 500V DIP MICA	1002-0024	Elmenco	DM15E220J
C50	CAP-470PF 5% 500V DIP MICA	1002-0035	Sangamo	D155F471
C51	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C52	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Panasonic	ECEA1HV0105
C53	CAP-620PF 5% 300V DIP MICA	1002-0038	Elmenco	DM15F621J
C54	CAP-36PF 5% 500V DIP MICA	1002-0041	Elmenco	DM15E360J
C55	CAP-82PF 5% 500V DIP MICA	1002-0020	Elmenco	DM15E820J
C56	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103A
C57	CAP-100PF 2% 500V DIP MICA	1002-0050	Elmenco	DM15F101G
C58	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C59	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C60	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C61	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C62	CAP-240PF 5% 500V DIP MICA	1002-0030	Elmenco	DM15F241J
C63	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C64	CAP-390PF 5% 500V DIP MICA	1002-0033	Cornell Dubilier	CD15FD391J
C65	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15E510J
C66	CAP-250PF 5% 500V DIP MICA	1002-0061	Elmenco	DM15F251J
C67	CAP-330PF 5% 500V DIP MICA	1002-0032	Elmenco	DM15F331J
C68	-0.002UF 20% 500V Z5U CER DISC	1005-0003	Tusonix	831596Z5U 202M
C69	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z

CE-4000

Table 6-17. Mod/Demod PCB Assembly (4400), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C70	Not used.			
C71	CAP-220PF 5% 500V DIP MICA	1002-0029	Elmenco	DM15F221J
C72	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15F510J
C73	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C74	CAP-100PF 5% 100V NPO MINTR CER	1005-0082	Tusonix	8121100C0G0 101J
C75	CAP-200PF 5% 500V DIP MICA	1002-0042	Elmenco	DM15F201J
C76	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15E510J
C77	CAP-36PF 5% 500V DIP MICA	1002-0041	Elmenco	DM15E360J
C78	CAP-100PF 25 500V DIP MICA	1002-0050	Elmenco	DM15F101G
C79	CAP-330PF 5% 500V DIP MICA	1002-0032	Elmenco	DM15F331J
C80	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15E510J
C81	CAP-330PF 5% 500V DIP MICA	1002-0032	Elmenco	DM15F331J
C82	CAP-1UFD -10+50% 50V RDL ELCTLT	1013-0047	Panasonic	ECEA1HV010S
C83	CAP-22UF 10% 15V AXL TANT	1011-0003	Sprague	150D226X901 5B2
C84	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	58235512Y5U 103Z
C85	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Panasonic	ECEA1CV101S
C86	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Panasonic	ECEA1CV101S
C87	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100		
C88	CAP-390PF 5% 100V NPO MINTR CER	1005-0140	Centre	200100NP0 391J
	DIODE			
CR1	DIO-1N957 SI ZENER DO7 6.8V 20% 0.4W	1281-0007	Motorola	1N957
CR2	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR3	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064

CE-4000

Table 6-17. Mod/Demod PCB Assembly (4400), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
CR4	DIO-H633 GE SIG DO7 1.5PF 40PRV	1282-0005		
CR5	DOP-MV104 SI DUAL VARICAP TO 92 40PF	1281-0058	Motorola	MV104
CR6	DIO-MV109 SI VARICAP A276 29PF 30PRV	1281-0064	Motorola	MV109
CR7	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
	INDUCTOR			
L1	CH-3B FERRITE BEAD 30GA/6T	1586-0007		
L2	CH-56UH 5% RF MLD AXL 0.16DX0.38L	1585-0042	Delevan	1537-64
L3	CH-22UH 10% RF MLD AXL 0.16DX0.38L	1585-0012	Delevan	1537-44
L4	CH-39UH 5% RF MLD AXL 0.16DX0.38L	1585-0043	Delevan	1537-56
L5	CH-1UH 10% RF MLD AXL 0.16DX0.38L	1585-0027	Delevan	1537-12
L6	CH-22UH 10% RF MLD AXL 0.16DX0.38L	1585-0012 1596-0104	Delevan	1537-44
L7	COIL 3.9 MHz			
L8	CH-12UH 10% RF MLD AXL 0.16DX0.38L	1585-0011	Gowanda	15/122
L9	CH-330UH 5% RF MLD AXL 0.19DX0.44L	1585-0045	Delevan	2500/04
L10	CH-220UH 5% RF MLD AXL 0.16DX0.38L	1585-0018	Delevan	1537-92
L11	CH-3B FERRITE BEAD 30GA/6T	1586-0007		
	TRANSISTOR			
Q1	XSTR-2N4275 NPN SI R110 LOW PWR/SW	1272-0016	Fairchild	2N4275
Q2	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q3	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q4	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q5	XSTR-2N3906 PNP SI TO 92 LOW PWR/SW	1272-0037	Motorola	2N3906

Table 6-17. Mod/Demod PCB Assembly (4400), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
Q6	XSTR-2N4392 SI TO 18 J-FET N-CHAN	1272-0054	Teledyne	2N4392
Q7	XSTR-2N4401 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q8	Not used.			
Q9	Not used.			
Q10	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0054	Motorola	2N3904
Q11	Not used.			
Q12	XSTR-2N4392 SI TO 18 J-FET N-CHAN	1272-0032	Teledyne	2N4392
Q13	Not used.			
Q14	Not used.			
Q15	Not used.			
Q16	Not used.			
Q17	Not used.			
Q18	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q19	XSTR-2N4392 SI TO 18 J-FET N-CHAN	1272-0054	Teledyne	2N4392
Q20	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q21	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q22	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q23	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q24	XSTR-2N3904 NPN SI TO 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q25	XSTR-2N4275 NPN SI R110 LOW PWR/SW	1272-0016	Fairchild	2N4275
Q26	XSTR-2N4393 SI TO 18 J-FET N-CHAN	1272-0055	Teledyne	2N4393
	RESISTOR			
R1	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R2	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R3	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R4	RES-18K 5% 1/4W CC	1066-1835	A. Bradley	CB1835
R5	RES-30.1K 1% 24PPM FILM	1074-0107	CAT.LIST	55-025
R6	RES-20K 5% 1/4W CC	1066-2035	A. Bradley	CB2035
R7	RES-2.2K 5% 1/4W CC	1066-2225	A. Bradley	CB2225

CE-4000

Table 6-17. Mod/Demod PCB Assembly (4400), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R8	RES-1K 1% 100PPM FILM	1075-0037	CAT.LIST	55-100
R9	RES-13K 1% 100PPM FILM	1075-0128	CAT.LIST	55-100
R10	RES-100K 1% 100PPM FILM	1075-0105	CAT.LIST	55-100
R11	RES-110K 1% 100PPM FILM	1075-0162	CAT.LIST	55-100
R12	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R13	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R14	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R15	RES-12K 5% 1/4W CC	1066-1235	A. Bradley	CB1235
R16	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R17	RES-100 OHM 1% 150PPM FILM	1074-1033	CAT.LIST	55-100
R18	RES-232 OHM 1% 100PPM FILM	1074-0097	CAT.LIST	55-100
R19	RES-2.2K 5% 1/4W CC	1066-2225	A. Bradley	CB2225
R20	RES-43 OHM 5% 1/4W CC	1066-4305	A. Bradley	CB4305
R21	RES-2K 1% 100PPM FILM	1075-0103	CAT.LIST	55-100
R22	RES-2.8K 1% 100PPM FILM	1075-0102	CAT.LIST	55-025
R23	POT-1K 20% 1/2W 4T CERMET TRMR	1203-0058	Beckman	91A-R2K
R24	RES-15K 5% 1/4W CC	1066-1535	A. Bradley	CB1535
R25	RES-15K 5% 1/4W CC	1066-1535	A. Bradley	CB1535
R26	RES-100K 5% 1/4W CC	1066-1045	A. Bradley	CB1045
R27	RES-237 OHM 1% 150PPM FILM	1074-1041	CAT.LIST	55-100
R28	RES-2.37K 1% 100PPM FILM	1075-0055	Dale	MFF-1/8
R29	RES-22 OHM 5% 1/4W CC	1066-2205	A. Bradley	CB2205
R30	RES-22K 5% 1/4W CC	1066-2235	A. Bradley	CB2235
R31	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R32	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R33	RES-1.5K 5% 1/4W CC	1066-1525	A. Bradley	CB1525
R34	RES-5.1MEG 5% 1/4W CC	1066-5155	A. Bradley	CB5255
R35	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R36	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R37	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R38	RES-12K 5% 1/4W CC	1066-1235	A. Bradley	CB1235
R39	RES-2.43K 1% 100PPM FILM	1075-0019	CAT.LIST	55-100
R40	Not used.			
R41	Not used.			
R42	Not used.			
R43	RES-11K 1% 100PPM FILM	1075-0169	CAT.LIST	55-100
R44	RES-1.5MEG 5% 1/4W CC	1066-1555	A. Bradley	CB1555
R45	RES-10K 1% 100PPM FILM	1075-0009	CAT.LIST	55-100
R46	RES-10K 1% 100PPM FILM	1066-6805	A. Bradley	CB6805
R47	RES-68 OHM 5% 1/4W CC	1066-4725	A. Bradley	CB4725

Table 6-17. Mod/Demod PCB Assembly (4400), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R48	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R49	RES-100K 5% 1/4W CC	1066-1045	A. Bradley	CB1045
R50	RES-110K 5% 1/4W CC	1066-1145		
R51	RES-110K 5% 1/4W CC	1066-1145		
R52	Not used.			
R53	Not used.			
R54	Not used.			
R55	RES-10K 1% 100PPM FILM	1075-0009	CAT .LIST	55-100
R56	RES-10L 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R57	RES-33K 5% 1/4W CC	1066-3335	A. Bradley	CB3335
R58	Not used.			
R59	RES-22.6K 1% 100PPM FILM	1074-1056	CAT.LIST	55-100
R60	POT-5K 20% 1/2W 4T CERMET TRMR	1203-0054	CAT.LIST	55-100
R61	RES-33K 5% 1/4W CC	1066-3335	A. Bradley	CB3335
R62	RES-5.1MEG 5% 1/4W CC	1066-5155	A. Bradley	CB5155
R63	Not used.			
R64	Not used.			
R65	Not used.			
R66	Not used.			
R67	Not used.			
R68	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R69	RES-2.21K 1% 100PPM FILM	1075-0010	CAT.LIST	55-100
R70	RES-10K 1% 100PPM FILM	1075-0009	CAT.LIST	55-100
R71	RES-22K 5% 1/4W CC	1066-2235	A. Bradley	
R72	RES-51.1 OHM 1% 100PPM FILM	1075-0077		
R73	Not used.			
R74	Not used.			
R75	Not used.			
R76	Not used.			
R77	RES-10MEG 5% 1/4W CC	1066-1065	A. Bradley	AB1065
R78	RES-100K 1% 100PPM FILM	1075-0105	CAT.LIST	55-100
R79	POT-100K 20% 1/2W 1T CERMET TRMR	1215-0046	CAT.LIST	55-100
R80	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R81	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R82	RES-5.1MEG 5% 1/4W CC	1066-5155	A. Bradley	CB5155
R83	RES-2.2K 5% 1/4W CC	1066-2225	A. Bradley	CB2225
R84	RES-15K 5% 1/4W CC	1066-1535	A. Bradley	CB1535
R85	RES-33K 5% 1/4W CC	1066-3335	A. Bradley	CB3335
R86	RES-13K 1% 100PPM FILM	1075-0128	CAT.LIST	55-100
R87	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R88	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R89	RES-20K 5% 1/4W CC	1066-2035	A. Bradley	CB2035
R90	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125

CE-4000

Table 6-17. Mod/Demod PCB Assembly (4400), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R91	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R92	RES-22 OHM 5% 1/4W CC	1066-2205	A. Bradley	CB2205
R93	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R94	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R95	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R96	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R97	RES-470 OHM 5% 1/4W CC	1066-4715	A. Bradley	CB4715
R98	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R99	RES-9.53K 1% 100PPM FILM	1074-1001	CAT.LIST	55-100
R100	RES-2.8K 1% 100PPM FILM	1075-0102	CAT.LIST	55-100
R101	RES-470 OHM 5% 1/4W CC	1066-4715	A. Bradley	CB4715
R102	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R103	RES-430 OHM 5% 1/4W CC	1066-4315	A. Bradley	CB4315
R104	RES-232 OHM 1% 100PPM FILM	1074-0097	CAT.LIST	55-100
R105	RES-22 OHM 5% 1/4W CC	1066-2205	A. Bradley	CB2205
R106	RES-1K 1% 100PPM FILM	1075-0037	CAT.LIST	55-100
R107	RES-22 OHM 5% 1/4W CC	1066-2205	A. Bradley	CB2205
R108	RES-22 OHM 5% 1/4W CC	1066-2205	A. Bradley	CB2205
R109	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R110	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R111	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R112	RES-910 OHM 5% 1/4W CC	1066-9115	A. Bradley	CB9115
R113	RES-470 OHM 5% 1/4W CC	1066-4715	A. Bradley	CB4715
R114	RES-470 OHM 5% 1/4W CC	1066-4715	A. Bradley	CB4715
R115	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R116	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R117	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R118	RES-36.5K 1% 100PPM FILM	1075-0113	CAT.LIST	55-100
R119	RES-56K 5% 1/4W CC	1066-5635	A. Bradley	CB5635
R120	POT-2K 20% 1/2W 1T CERMET TRMR	1203-0072	Beckman	91A-R2K
R121	RES-2.8K 1% 100PPM FILM	1075-0102	CAT.LIST	55-100
R122	RES-3.48K 1% 100PPM FILM	1075-0093	CAT.LIST	55-100
R123	RES-43.2K 1% 100PPM FILM	1075-0117	CAT.LIST	55-100
R124	RES-200K 1% 100PPM FILM	1075-0148	CAT.LIST	55-100
R125	RES-12.1K 1% 25PPM FILM	1074-1030	CAT.LIST	55-025
R126	RES-1.82K 1% 100PPM FILM	1075-0065	CAT.LIST	55-100
R127	RES-51.1K 1% 100PPM FILM	1075-0009	CAT.LIST	55-025

Table 6-17. Mod/Demod PCB Assembly (4400), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R128	POT-10K 10% 1/2W 25T CERMET TRMR	1215-0047	Bourns	3299X11-103
R129	RES-33.2K 1% 100PPM FILM	1075-0098		
R130	Not used.			
R131	RES-2.2K 5% 1/4W CC	1066-2225	A. Bradley	CB2225
R132	RES-1K 1% 100PPM FILM	1075-0037	CAT.LIST	55-100
R133	RES-10K 1% 100PPM FILM	1075-0009	CAT.LIST	55-100
R134	RES-43.2K 1% 100PPM FILM	1075-0117		
R135	RES-51.1K 1% 100PPM FILM	1075-0099	CAT.LIST	55-100
R136	POT-500 OHM 20% 1/2W 1T CERMET TRMR	1215-0042	Beckman	91AR500
R137	RES-1.43K 1% 100PPM FILM	1075-0021	CAT.LIST	55-100
R138	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R139	RES-100K 5% 1/4W CC	1066-1045	A. Bradley	CB1045
R140	RES-360K 5% 1/4W CC	1066-3645	A. Bradley	CB3645
R141	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R142	Not used.			
R143	POT-1K 20% 1/2W 1T CERMET TRMR	1215-0058	Beckman	91AR1K
R144	RES-3K 5% 1/4W CC	1066-3025	A. Bradley	CB3025
R145	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R146	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R147	RES-220K 5% 1/4W CC	1066-2245	A. Bradley	CB2245
R148	RES-220K 5% 1/4W CC	1066-2245	A. Bradley	CB2245
R149	POT-10K 1/2W 25T CERMET TRMR	1215-0047	Bourns	3299X1-103
R150	RES-130K 1% 25PPM FILM	1074-0110	CAT.LIST	55-025
R151	RES-78.7K 1% 100PPM FILM	1075-0060	CAT.LIST	55-100
R152	RES-110K 1% 100PPM FILM	1074-0109	CAT.LIST	55-025
R153	RES-53.6K 1% 150PPM FILM	1074-1023	CAT.LIST	55-100
R154	POT-10K 10% 1/2W 25T CERMET TRMR	1215-0047	Bourns	3299X1-103
	INTEGRATED CIRCUIT			
U1	IC-LM308N OP AMPL 8 PIN	2025-0070	National	LM308N
U2	IC-LM308N OP AMPL 8-PIN	2025-0070	National	LM308N

Table 6-17. Mod/Demod PCB Assembly (4400) Parts List (Concluded).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
U3	IC-74221 16 PIN DIP MONSTABLE MV	1025-0271	Texas Instruments	SN74221N
U4	IC-UA741CP	2025-0067	Texas Inst	UA741CP
U5	IC-CA 3046 XSTR AND DIO ARRAY	2025-0171	RCA	CA3046
U6	IC-UA710C HI SPD DIFFERENTIAL COMPTR	1025-0028	Fairchild	710HC
U7	IC-UA710C HI SPD DIFFERENTIAL COMPTR	1025-0028	Fairchild	710HC
U8	IC-LM308N OP AMPL 8 PIN	2025-0070	National	LM308N
U9	IC-TL081 8 PIN DIP J-FET-INP OP AMPL	2025-0199	Texas Instruments	TL081CP
U10	IC-LM308N OP AMPL 8 PIN	2025-0070	National	LM308N
U11	IC-UA741CP	2025-0067	Texas Inst	UA741CP
U12	IC-311 VOLTAGE COMPARATOR	2025-0181	National	LM311N
U13	IC-LM308N OP AMPL 8 PIN	2025-0070	National	LM308N
U14	IC-OP-08 8 PIN CAN OP AMPL	2025-0187	Precision Monolithic	OP-08GJ
U15	IC-74121 14 PIN DIP MONSTABLE MV	2025-0272	Texas Instruments	SN74121N
U16	IC-LM308N OP AMPL 8 PIN	2025-0070	National	LM308N
U17	IC-UA741CP	2025-0067	Texas Inst	UA741CP
U18	IC-LM308N OP AMPL 8 PIN	2025-0070	National	LM308N
U19	IC-UA741CP	2025-0067	Texas Inst	UA741CP
	CONNECTOR			
P2	CONN-12(2X6) PIN 0.1X0.1SP STR PCB MTJK	2535-0151	Berg Elect	65610-412
	RELAY			
K1	RLY-DPDT 6VDC COIL 2C 2A PCB MT	1313-0036	Aromat Corp	HB2-6V
K2	RLY-SPDT 12VDC COIL FORM C PCB MT	1313-0017	ITT	M212HG
	CRYSTAL			
Y1	XTAL-5.5MHz	2035-0045	McCoy Cryst	CR-69A/V

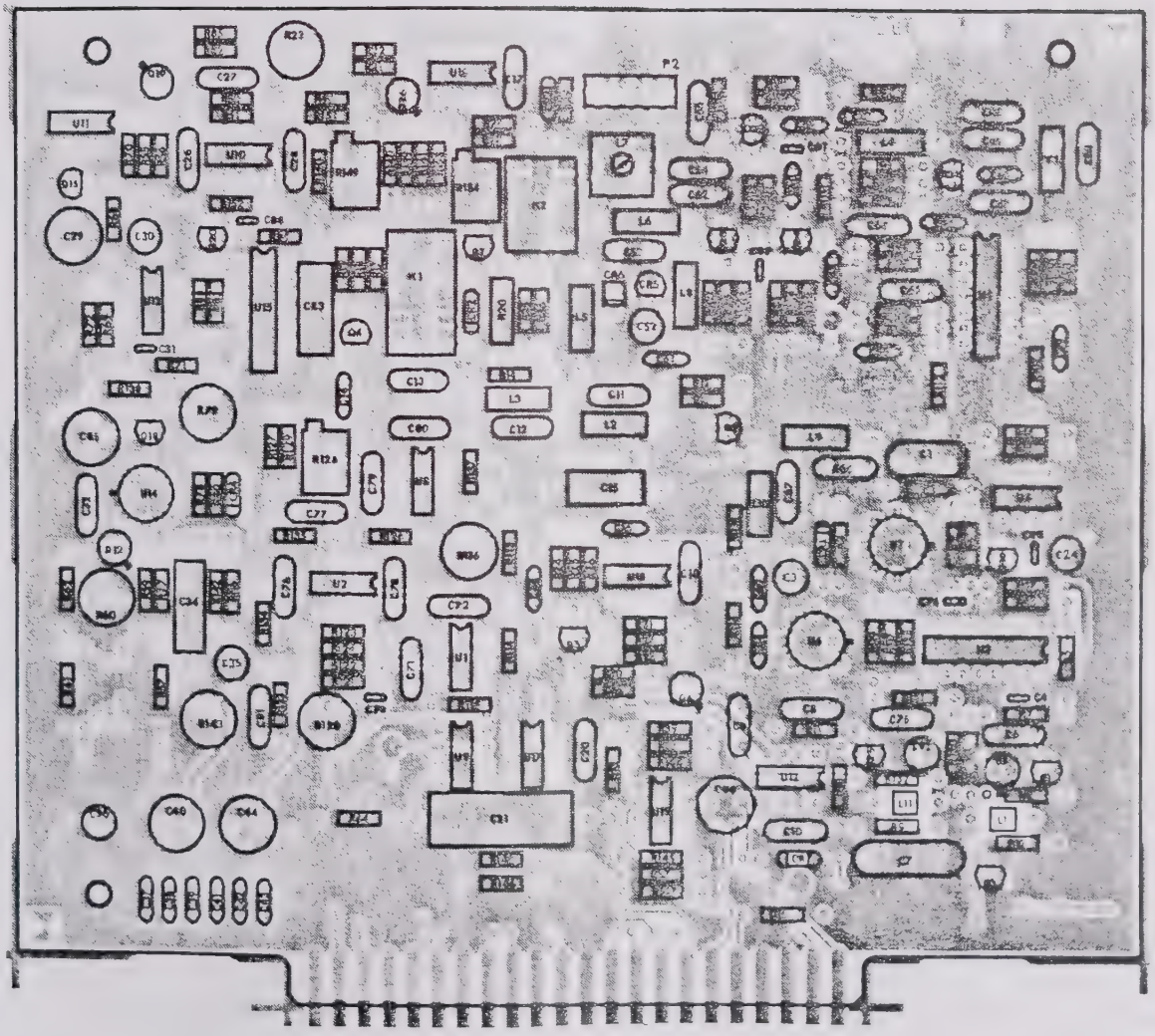


Figure 6-36. MOD/DEMOD (4400) Component Location.

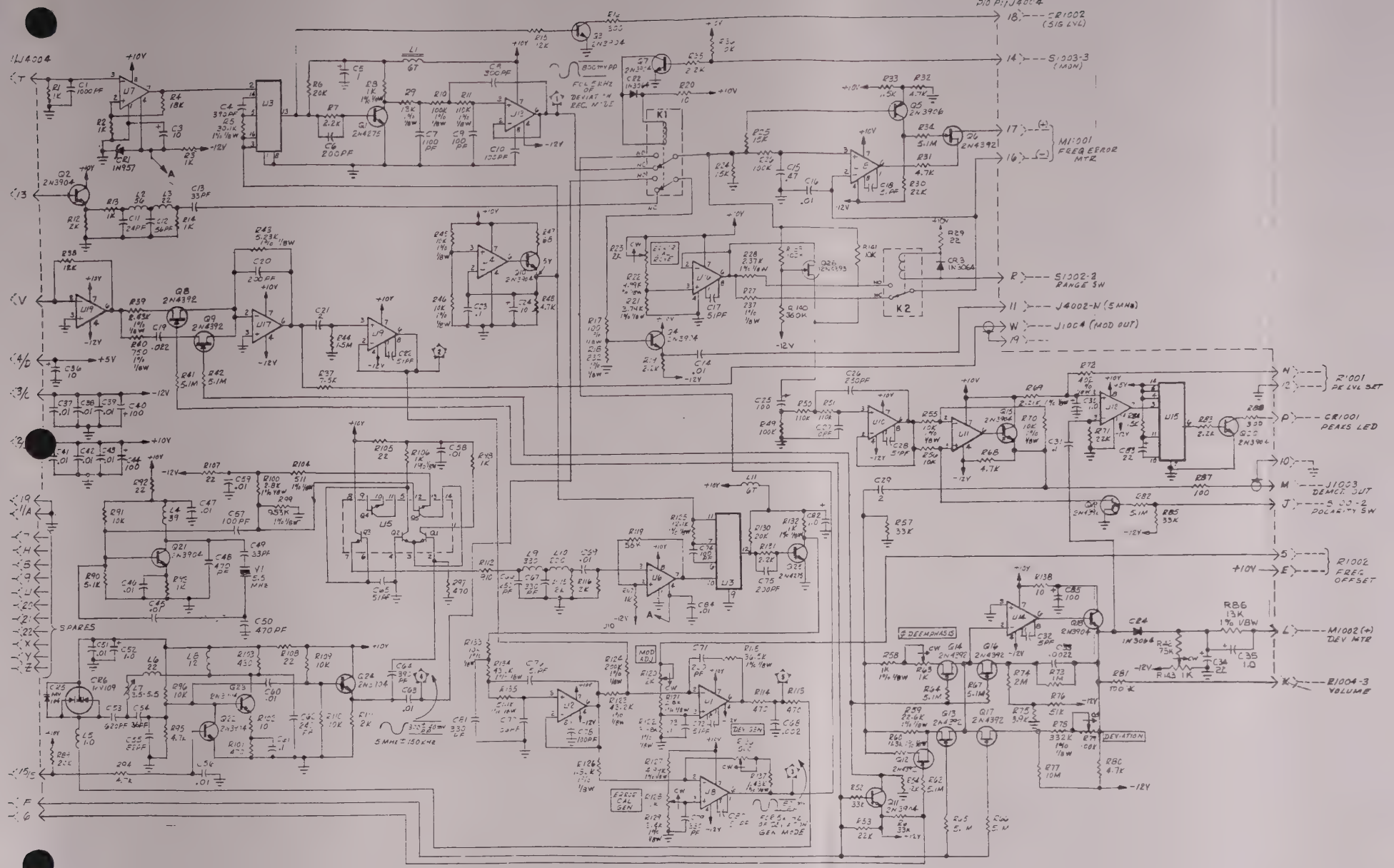


Figure 6-37. MOD/DEMOD (4400) Schematic Diagram.

Table 6-18. YIG Driver/10.7 MHz IF (4500), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
4500	PCB ASSY-YIG DRIVER	7001-0806	Cushman	CE-4000
	CAPACITOR			
C1	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Panasonic	ECEA1CV101S
C2	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C3	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25
C4	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15E501J
C5	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C6	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Panasoic	ECEA1CV1015
C7	CAP-470UF +50-10% 25V EXL ELCTLT	1014-0020	Illinois Cap	477TTA025A
C8	CAP-0.22UF 10% 100V RDL MET-MYLAR	1008-0091	Electrocube	232A1B224K
C9	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15E510J
C10	CAP-0.22UF 10% 100V RDL MET-MYLAR	1008-0091	Elmenco	DM19822J
C11	CAP-51PF 5% 500V DIP MICA	1002-0045	Tusonix	5835512Y5U 103Z
C12	CAP-8200PF 5% 100V DIP MICA	1002-0076	Plessey Cap	60G684K100
C13	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Panasonic	ECEA1HV010S
C14	CAP-0.68UF 10% 100V RDL MET-POLYEST	1008-0108	Tusonix	5835512Y5U 103Z
C15	CAP-1UF -10%+50% 50V RDL ELCTLT	1013-0047	Plessey	ECEA1HV010S
C16	CAP-0.01UF +80-20% 25V Y5U DER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C17	CAP-0.01UF +80-20% 25V Y5U DER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C18	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C19	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097		
C20	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035		

CE-4000

Table 6-18. YIG Driver/10.7 MHz IF, (4500), Parts List
(Continued.)

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C21	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25
C22	CAP-200PF 5% 500V DIP DIP MICA	1002-0042	Elmenco	DM15F201J
C23	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C24	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix Tusonix	5835512Y5U 103Z
C25	CAP-30PF 5% 500V DIP M DIP MICA	1004-0010		
C26	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C27	CAP-56PF 5% 50V N750 M MINTR CER	1005-0142		
C28	Not Used			
C29	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C30	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C31	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C32	CAP-68PF 5% 50V N470 M MINTR CER	1005-0143		
C33	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C34	CAP-220PF 5% 500V DIP DIP MICA	1002-0029		
C35	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C36	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C37	CAP-560PF 5% 300V DIP DIP MICA	1002-0037		
C38	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C39	CAP-10UF +100-10% 25V 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25
C40	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C41	CAP-0.01UF 20% 100V Y5 Y5P MINTR CER WH	1005-0100	Erie	812110065103M
C42	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25
C43	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25

CE-4000

Table 6-18. YIG Driver/10.7 MHz (4500), Parts List
(Continued).

CKT. REF.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C44	Not used			
C45	Not used			
C46	Not used			
C47	Not used			
C48	Not used			
C49	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C50	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C51	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25
C52	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C53	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C54	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C55	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C56	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C57	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C58	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050561 104M
C59	CAP-1UF -10%+50% 50V RDL ELCTLT	1013-0047	Panasonic	ECEA1HV010S
C60	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C61	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050561 104M
C62	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050561 104M
C63	CAP-200PF 5% 500V DIP MICA	1002-0042	Elmenco	DM15E300J
C64	CAP-270PF 5% 300V DIP MICA	1004-0016	Cornell Dubilier	DM15C100J CD115CD100J
C65	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	5835512Y5U 103Z
C66	CAP-15PF 5% 500V DIP MICA	1002-0001	Elmenco	DM15C150J
C67	CAP-390PF 5%; 500V DIP MICA	1002-0033	Cornellic Dubilier	CD15FD391J

Table 6-18. YIG Driver/10.7 MHz IF (4500), Parts List
(Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C68	CAP-390PF 5% 500V DIP MICA	1002-0033	Cornell Dubilier	CD15FD391J
C69	CAP-390PF 5% 500V DIP MICA	1002-0033	Cornell Dubilier	CD15FD391J
C70	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Erie	5835520Y5U S103
C71	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25
C72	CAP-0.0018UF 10% 100V RDL POLYESTER	1008-0013	Sprague	225P18291WA3
C73	CAP-1000PF 5% 100V DIP MICA	1002-0015	Elmenco	DM15F102J
C74	CAP-15PF 5% 500V DIP MICA	1002-0001	Elmenco	DM15G150J
C75	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C76	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Panasonic	ECEA1HV010S
C77	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C78	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Cap	10PC25
C79	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C80	CAP-0.0022UF 10% 100V RDL POLYESTER	1008-0020	Sprague	225P22291WA3
C81	CAP-0.0068UF 10% 200V AXL POLYESTER	1008-0012	Sprague	192P68292
C82	CAP-0.0022UF 10% 100V RDL POLYESTER	1008-0020	Sprague	226P22291WA3
C83	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 104M
C84	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Erie	5835520Y5U S103
C85	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Illinois Cap	107RAR016B
C86	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Panasonic	ECEA1HV010S
C87	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C88	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C89	CAP-1000PF 5% 100V DIP MICA	1002-0015	Elmenco	DM15F102J
C90	CAP-1000PF 5% 100V DIP MICA	1002-0015	Elmenco	DM15F102J

Table 6-18. YIG Driver/10.7 MHz IF (4500), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C91	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C92	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C93	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C94	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C95	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C96	CAP-10PF 5% 500V DIP MICA	1002-0016	Elmenco	DM15C100J
	DIODES			
CR1	DIO-IN3064 SI SW DO7/DO35 75 PRV	1281-0013	Fairchild	1N3640
CR2	DIO-LT EMIT W ANG W/MTG GROM	1281-0073	Chicago Mini Lamp	CM4-73 W/Mt
CR3	DIO-IN3064 SI SW DO7/DO35 75 PRV	1281-0013	Fairchild	1N3640
CR4	DIO-IN3064 SI SW DO7/DO35 75 PRV	1281-0013	Fairchild	1N3640
CR5	DIO-IN3064 SI SW DO7/DO35 75 PRV	1281-0013	Fairchild	1N3640
CR6	DIO-IN3064 SI SW DO7/DO35 75 PRV	1281-0013	Fairchild	1N3640
CR7	DIO-IN3064 SI SW DO7/DO35 75 PRV	1281-0013	Fairchild	1N3640
CR8	DIO-IN3064 SI SW DO7/DO35 75 PRV	1281-0013	Fairchild	1N3640
CR9	DIO-IN3064 SI SW DO7/DO35 75 PRV	1281-0013	Fairchild	1N3640
	FILTERS			
FL1	FLTR-XTAL 10.7MHz 3dB BW 22kHz	1040-0041	Piezo	C/E DWG
FL2	FLTR-CER 10.7MHz 3dB BW 280kHz	1040-0043	Muriata Corp	10.7MHz Red Only
FL3	FLTR-CER 10.7MHz 3dB BW 280kHz	1040-0043	Muriata Corp	1Ø.7 MHz Red Only

CE-4000

Table 6-18. YIG Driver/10.7 MHz IF (4500), Parts List
(Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	INDUCTOR			
L1	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
L2	CH-100UH 10% RF MLD AXL 0.10DX0.25L	1585-0054	Delevan	1025-68
L3	COIL 3.9 MHz	1596-0104		
L4	CH-1000UH 10% RF MLD AXL 0.10DX0.25L	1585-0085	Delevan	1025-92
L5	CH-100UH 10% RF MLD AXL 0.10DX0.25L	1585-0085	Delevan	1025-92
L6	CH-100UH 10% RF MLD AXL 0.10DX0.25L	1585-0085	Delevan	1025-92
L7	Not used			
L8	COIL 3.9 MHz	1596-0104		
L9	CH-100UH 10% RF MLD AXL 0.10DX0.25L	1585-0054	Delevan	1025-68
L10	CH-100UH 10% RF MLD AXL 0.10DX0.25L	1585-0054	Delevan	1025-68
L11	CH-180UH 5% RF MLD AXL 0.16DX.0.381	1585-0035	Delevan	1537-88
L12	CH-1000UH 5% RF MLD AXL 0.19DX0.44L	1585-0020	Delevan	2500-28
L13	CH-1000UH 5% RF MLD AXL 0.19DX0.44L	1585-0020	Delevan	2500-28
L14	CH-100UH 5% RF MLD AXL 0.16DX0.38L	1585-0017	Delevan	1537-76
	TRANSFORMER			
Q1	XSTR-2N2219 NPN SI to 5 LOW PWR	1272-0036	Fairchild	2N2219
Q2	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q3	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q4	XSTR -92PU45 NPN S1 DARLINGTON	1272-0113	National	92PU45
Q5	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q6	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q7	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904

CE-4000

Table 6-18. YIG/Driver/10.7MHz IF (4500), Parts List
(Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
Q8	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q9	XSTR-2N4416 S1 to 72 J-FET N-CHAN	1272-0048		
Q10	Not used			
Q11	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q12	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q13	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q14	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q15	XSTR-2N3906 PNP S1 to 92 LOW PWR/SW	1272-0037		
Q16	Not used			
Q17	Not Used			
Q18	Not Used			
Q19	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q20	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q21	XSTR -92PU45 NPN S1 DARLINGTON	1272-0113	National	92PU45
Q22	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q23	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q24	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q25	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
Q26	XSTR-2N3904 NPN S1 to 92 LOW PWR/SW	1272-0032	Motorola	2N3904
	RESISTOR			
R1	POT 500 OHM 10% 3/4 W 15T CERMET TRMR	1215-0011	Helitrim	89WR
R2	RES-4.32K 1% 100PPM FILM	1075-0111	CAT.LIST	55-100
R3	RES-22 OHM 5% 1/4W CC	1066-2205	A. Bradley	CB2205

CE-4000

Table 6-18. YIG/Driver 10.7 MHz IF (4500), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK	MANUFACTURER	MFR. NO.
R4	POT-500 OHM 10% 3/4W 15T CERMET TRMR	1215-0011	Helitrim	89WR
R5	RES-4.64K 1% 25PPM FILM	1074-1005	CAT.LIST	55-100
R6	RES-1.82K 1% 25PPM FILM	1075-0080	CAT.LIST	55-100
R7	RES-5.62K 1% 25PPM FILM	1074-0111	CAT.LIST	55-025
R8	RES-887 OHM 1% 100PPM FILM	1075-0022	CAT.LIST	55-100
R9	RES-56.2 OHM 1% 2PPM AXL WW	1157-0001	Jordan	5190+0R2PPM1%
R10	RES-27K 5% 1/4 CC	1066-2735	A. Bradley	CB2735
R11	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R12	POT-2K 10% 3/4W 15T CERMET TRMR	1215-0015	Beckman	89WR2K
R13	RES-4.02K 1% 100PPM FILM	1075-0094	CAT.LIST	55-100
R14	RES-255K 1% 100PPM FILM	1075-0017	CAT.LIST	55-100
R15	RES-750 OHM 5% 1/4W CC	1066-7515	A. Bradley	CB7515
R16	RES-150K 1% 100PPM FILM	1075-0152	CAT.LIST	55-100
R17	RES-27.4K 1% 150PPM FILM	1074-1004	CAT.LIST	55-100
R18	RES-300K 5% 1/4W CC	1066-3045	A. Bradley	CB3045
R19	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R20	RES -2.2K 5% 1/4W CC	1066-2225	A. Bradley	CB2225
R21	RES-150K 5% 1/4W CC	1066-1545	A. Bradley	CB1535
R22	RES-4.02K 1% 25PPM FILM	1074-1026	CAT.LIST	55-100
R23	RES-5.11K 1% 150PPM FILM	1074-1018	CAT.LIST	55-100
R24	RES-200 OHM 5% 2W CC	1069-2015	A. Bradley	CB2015
R25	RES-36 OHM 5% 1/2W CC	1067-3605		
R26	RES-22K 5% 1/4W CC	1066-2235	A. Bradley	CB2235
R27	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1036
R28	RES-100K 5% 1/4W CC	1066-1045	A. Bradley	CB1045
R29	RES-470K 5% 1/4W CC	1066-4745	A. Bradley	CB4745
R30	RES-2.2K 5% 1/4W CC	1066-2225	A. Bradley	CB2225
R31	RES-680 OHM 5% 1/4W CC	1066-6815	A. Bradley	CB6815
R32	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R33	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R34	RES-300 OHM 5% 1/4W CC	1066-3015	A. Bradley	CB3015
R35	RES-680 OHM 5% 1/4W CC	1066-6815	A. Bradley	CB6815
R36	RES-6.8K 5% 1/4W CC	1066-6825	A. Bradley	CB5925
R37	RES-15K 5% 1/4W CC	1066-1535	A. Bradley	CB1535

CE-4000

Table 6-18. YIG Driver/10.7 MHz IF (4500), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R38	RES-1.8K 5% 1/4W CC	1066-1825	A. Bradley	CB1825
R39	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R40	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R41	RES-4-7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R42	Not used			
R43	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R44	RES-750 OHM 5% 1/4W CC	1066-7515	A. Bradley	CB7515
R45	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R46	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R47	Not used			
R48	Not used			
R49	RES-750 OHM 5% 1/4W CC	1066-7515	A. Bradley	CB7515
R50	POT-50K 20% 1/2W IT CERMET TRMR	1203-0070	Beckman	91AR50K
R51	RES-100K 5% 1/4W CC	1066-1045	A. Bradley	CB1045
R52	RES-2.7K 5% 1/4W CC	1066-2725	A. Bradley	CB2725
R53	RES-2.7K 5% 1/4W CC	1066-2725	A. Bradley	CB2725
R54	Not used			
R55	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB47255
R56	RES-3.9K 5% 1/4W CC	1066-3925	A. Bradley	CB3925
R57	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R58	RES-1.8K 5% 1/4W CC	1066-1825	A. Bradley	CB1825
R59	RES-6.2K 5% 1/4W CC	1066-6225	A. Bradley	CB6225
R60	RES-18K 5% 1/4W CC	1066-1835	A. Bradley	CB1835
R61	RES-160 OHM 5% 1/4W CC	1066-1615	A. Bradley	CB1615
R62	RES-390k OHM 5% 1/4W CC	1066-3915	A. Bradley	CB3915
R63	RES-36K 5% 1/4W CC	1066-3635	A. Bradley	CB3635
R64	RES-360 OHM 5% 1/4W CC	1066-3615	A. Bradley	CB3615
R65	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R66	Not used			
R67	RES-150 OHM 5% 1/4W CC	1066-1515	A. Bradley	CB1515
R68	RES-390 OHM 5% 1/4W CC	1066-3915	A. Bradley	CB3915
R69	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R70	RES -5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R71	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R72	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R73	Not used			
R74	Not used			
R75	Not used			
R76	Not used			
R77	Not used			

CE-4000

Table 6-18. YIG Driver/10.7 MHz IF (4500), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R78	Not used			
R79	Not used			
R80	Not used			
R81	RES-15K 5% 1/4W CC	1066-1515	A. Bradley	CB1515
R82	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R83	RES-91 OHM 5% 1/4W CC	1066-9105	A. Bradley	CB9105
R84	RES-1.8K 5% 1/4W CC	1066-1825	A. Bradley	CB1825
R85	RES-18K 5% 1/4W CC	1066-1835	A. Bradley	CB1835
R86	RES-RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R87	RES-390 OHM 5% 1/4W CC	1066-3915	A. Bradley	CB3915
R88	RES-160 OHM 5% 1/4W CC	1066-1615	A. Bradley	CB1615
R89	RES-22MEG 5% 1/4W CC	1066-2265	A. Bradley	CB2265
R90	RES-390 OHM 5% 1/4W CC	1066-3615	A. Bradley	CB3615
R91	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R92	RES-51 OHM 5% 1/4W CC	1066-5105	A. Bradley	CB5105
R93	RES-3.9K 5% 1/4W CC	1066-3925	A. Bradley	CB3925
R94	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R95	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R96	RES-15K 5% 1/4W CC	1066-1535	A. Bradley	CB1535
R97	RES-3.9K 5% 1/4W CC	1066-3925	A. Bradley	CB3925
R98	RES-150 OHM 5% 1/4W CC	1066-1515	A. Bradley	CB1515
R99	RES-1.8K 5% 1/4W CC	1066-1825	A. Bradley	CB1825
R100	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R101	RES-330 OHM 5% 1/4W CC	1066-3315	A. Bradley	CB3315
R102	RES-390 OHM 5% 1/4W CC	1066-3915	A. Bradley	CB3915
R103	Not used			
R104	RES-100K 5% 1/4W CC	1066-1045	A. Bradley	CB1045
R105	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R106	RES-1MEG 5% 1/4W CC	1066-1055	A. Bradley	CB1055
R107	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R108	RES-2K 5% 1/4W CC	1066-2025	A. Bradley	CB2025
R109	RES-22MEG 5% 1/4W CC	1066-2265	A. Bradley	CB2265
R110	RES-36K 5% 1/4W CC	1066-3635	A. Bradley	CB3635
R111	RES-1.8K 15% 1/4W CC	1066-1825	A. Bradley	CB1825
R112	RES-3.9K 5% 1/4W CC	1066-3925	A. Bradley	CB3925
R113	RES-12K 5% 1/4W CC	1066-1235	A. Bradley	CB1235
R114	RES-12K 5% 1/4W CC	1066-1235	A. Bradley	CB1235
R115	RES-1.43K 1% 100PPM FILM	1075-0021	CAT.LIST	55-100
R116	RES-5.11K 1% 150PPM FILM	1074-1018	CAT.LIST	55-100
R117	RES-261 OHM 1% 100PPM FILM	1074-1054	CAT.LIST	55-100

CE-4000

Table 6-18. YIG Driver/10.7 MHz IF (4500), Parts List (Continued).

REF. No.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R118	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R119	RES-470 OHM 5% 1/4W CC	1066-4715	A. Bradley	CB4715
R120	RES-330 OHM 5% 1/4W CC	1066-3315	A. Bradley	CB3315
R121	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R122	RES-RES-2.2K 5% 1/4W CC	1066-2225	A. Bradley	CB2225
R123	RES-1K 1% 100PPM FILM	1075-0037	CAT.LIST	55-100
R124	RES-51 OHM 5% 1/4W CC	1066-5105	A. Bradley	CB5105
R125	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R126	RES-22 OHM 5% 1/4W CC	1066-2205	A. Bradley	CB2205
R127	RES-1.43K 1% 100PPM FILM	1075-0021	CAT.LIST	55-100
R128	RES-5.11K 1% 150PPM FILM	1074-1018	CAT.LIST	55-100
R129	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R130	RES-430 OHM 5% 1/4W CC	1066-4315	A. Bradley	CB4315
R131	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R132	RES-22 OHM 5% 1/4W CC	1066-2205	A. Bradley	CB2205
R133	RES-1.21K 1% 100PPM FILM	1075-0042	CAT.LIST	55-100
R134	RES-1.1K 5% 1/4W CC	1066-1125	A. Bradley	CB1125
R135	RES-10 OHM 5% 1/4W CC	1066-1105	A. Bradley	CB1105
R136	RES-820 OHM 5% 1/4W CC	1066-8215	A. Bradley	CB8215
R137	RES-2.2K 5% 1/4W CC	1066-2225	A. Bradley	CB2225
R138	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R139	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R140	RES-15K 5% 1/4W CC	1066-1535	A. Bradley	CB1535
R141	RES-3.9K 5% 1/4W CC	1066-3925	A. Bradley	CB3925
R142	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R143	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R144	RES-100 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R145	RES-100 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R145	RES-51 OHM 5% 1/4W CC	1066-5105	A. Bradley	CB5105
	SWITCH			
S1	SW-DPST MINTR SLIDE	1850-0020	Alco	MSS-22-1
	INTEGRATED CIRCUIT			
U1	IC-4008 816 PIN DIP 4-BIT FULL ADDER	2025-0183	Motorola	MC14008BCP
U2	IC-4008 816 PIN DIP 4-BIT FULL ADDER	2025-0183	Motorola	MC14008BCP

CE-4000

Table 6-18. YIG Driver/10.7 MHz IF (4500), Parts List (Continued).

REF. No.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
U3	IC-08 16 PIN DIP D/A CONVERTER	2025-0188	Signetics	NE5008
U4	IC-LM308N OP AMPL 8 PIN	2025-0070	National	LM308N
U5	IC-3130 8 PIN DIP OP AMPL	2025-0269	RCA	CA313E
U6	IC-CA 3140E 8 PIN DIP OP AMPL	2025-0237	RCA	CA3140E
U7	IC-CA 3046 XSTR AND DIO ARRAY	2025-0171	RCA	CA3046
U8	IC-CA 3046 XSTR AND DIO ARRAY	2025-0171	RCA	CA3046
U9	IC-74LS93 14 PIN DIP 4-BIT BIN CNTR	2025-0261	Texas Instruments	SN74LS93N

CE-4000

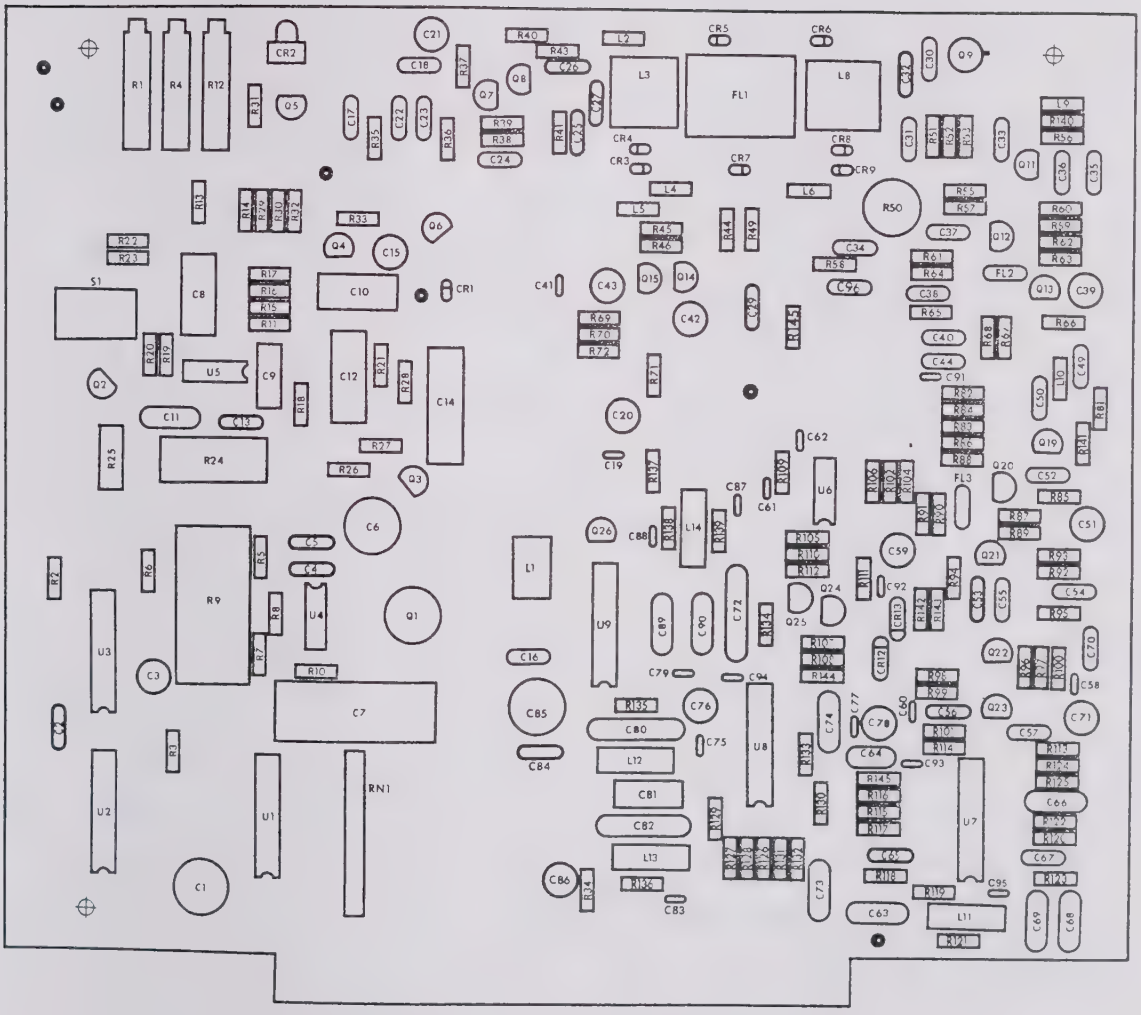


Figure 6-38. YIG Driver and 10.7 MHz IF (4500) Component Location.

CE-4000

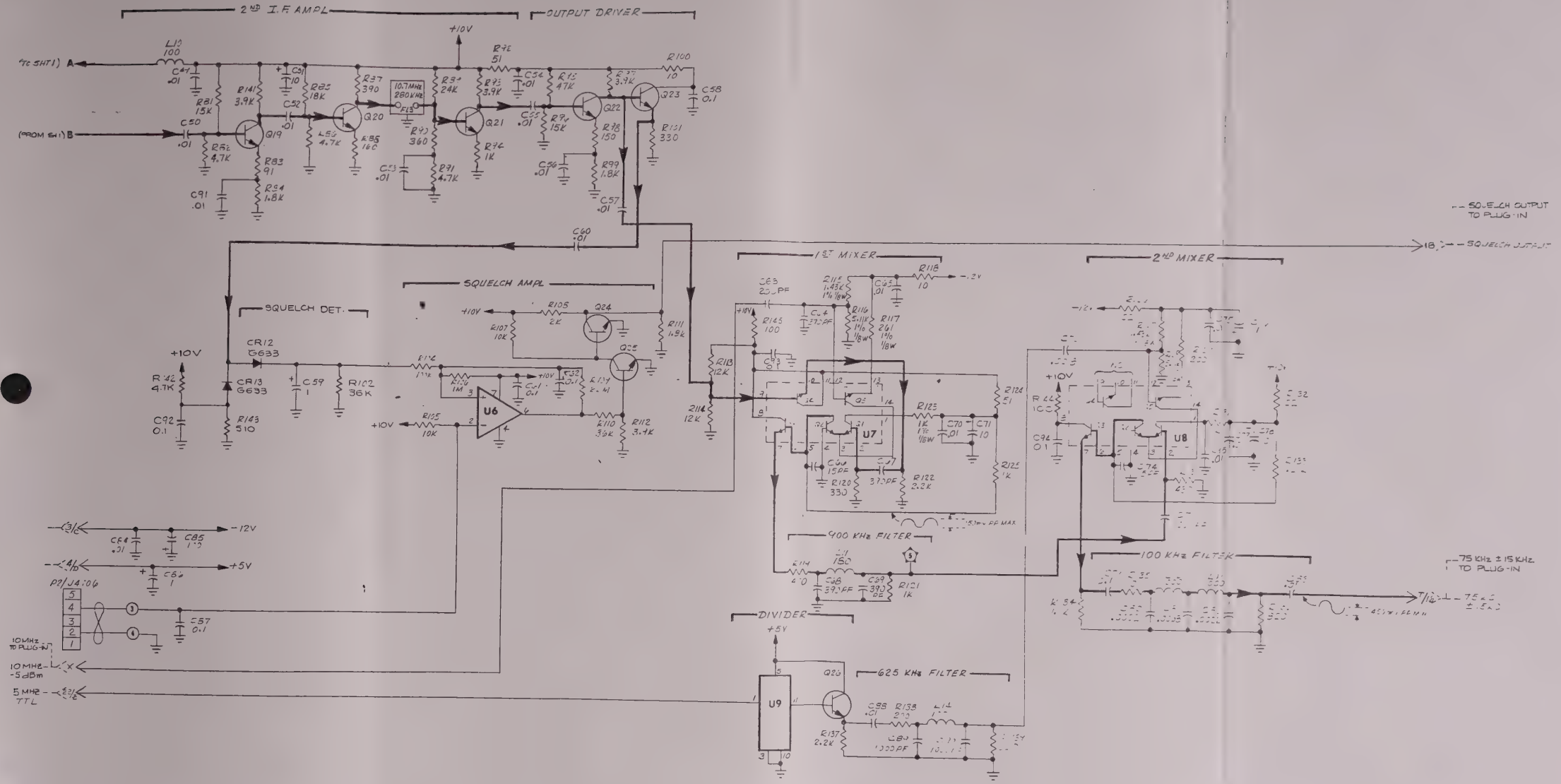


Figure 6-39. YIG Driver/10.7 MHz IF (4500) Schematic Diagram (Sheet 2)

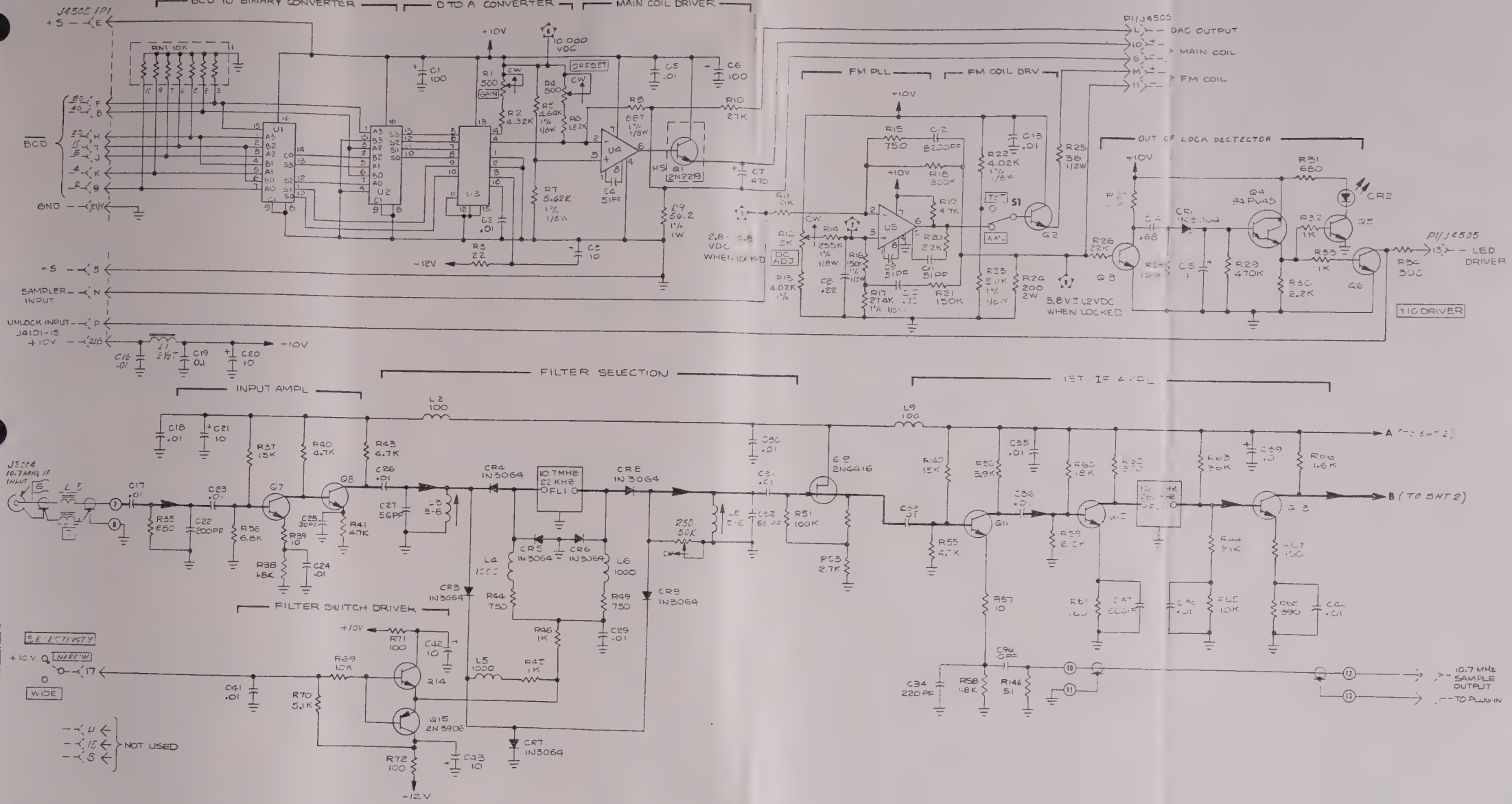


Figure 6-39. YIG Driver/10.7 MHz IF (4500) Schematic Diagram

CE-4000

Table 6-19. Relay Control (4700), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	CAPACITOR			
C1	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 104M
C2	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 104M
C3	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 104M
C4	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 104M
C5	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 104M
	DIODE			
CR1	DIO-1N914B SI SW DO7 75 PRV 0.25W	1281-0112		
	CONNECTOR			
J1	CONN-SMB 50 OHM STR JK PC MT SNAP-ON	2536-0071	Sealectro	510510000
J2	CONN-SMB 50 OHM STR JK PC MT SNAP-ON	2536-0071	Sealectro	510510000
J3	CONN-SMB 50 OHM STR JK PC MT SNAP-ON	2536-0071	Sealectro	510510000
J4	CONN-SMB 50 OHM STR JK PC MT SNAP-ON	2536-0071	Sealectro	510510000
J5	CONN-5 PIN 0.025SQ 0.1SP PCB MT JK	2535-0171	Sealectro	510510000
J6	CONN-5 PIN 0.025SQ 0.1SP PCB MT JK	2535-0171	Sealectro	510510000
	RELAY			
K1	RLY-DPDT 12VDC COIL 1A CONT TO5 CASE	1313-0021	Teledyne	71212
K2	RLY-DPDT 12VDC COIL 1A CONT TO5 CASE	1313-0021	Teledyne	71212
	RESISTOR			
R1	POT-500K 10% 3/4W 1ST CERMET TRMR	1215-0041	Beckman	89WR50K

CE-4000

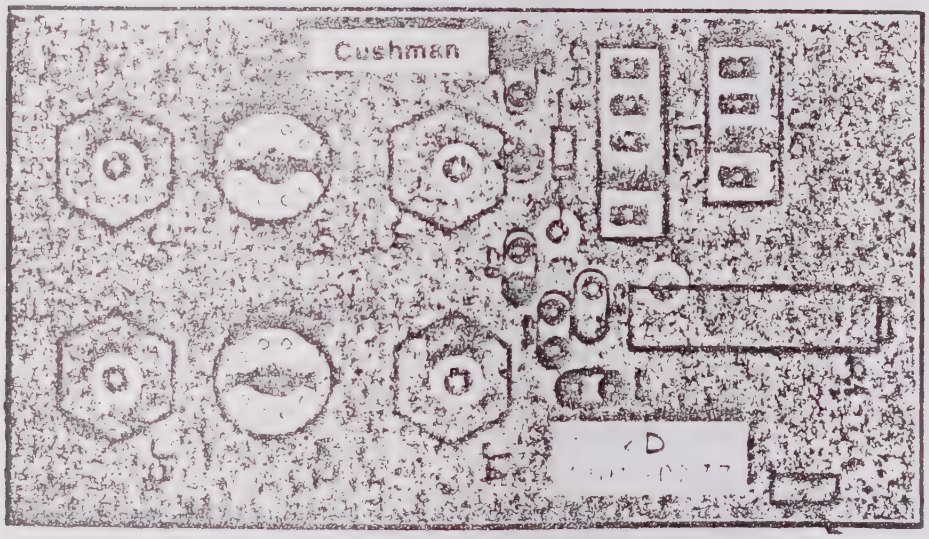


Figure 6-40. Relay Control (4700) Component Locations.

CE-4000

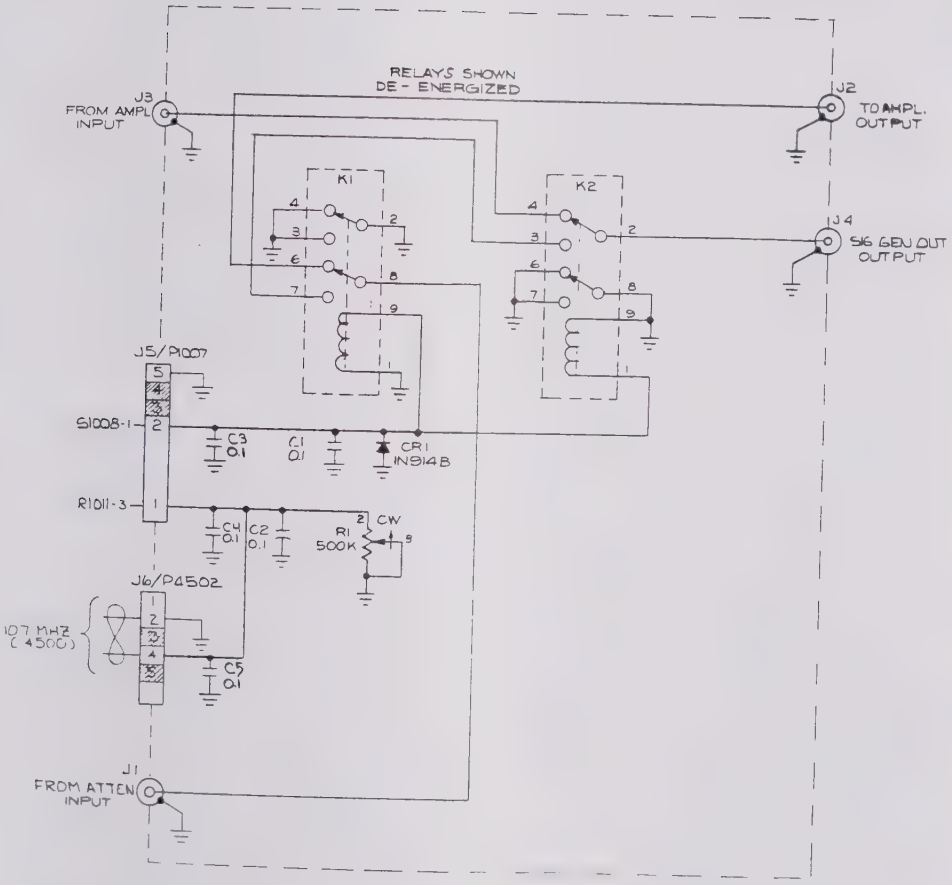


Figure 6-41. Relay Control (4700) Schematic Diagram.

CE-4000

Table 6-20. PCB Assembly SINAD (4800), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	CAPACITOR			
C1	CAP-0.1UF 20% 5V MINTR CER RED	1005-0097	Erie	8121100651 104M
C2	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Inc	CSR100161
C3	CAP-0.1UF 20% 5V MINTR CER RED	1005-0097	Erie	8121100651 103M
C4	CAP-15UF +100-10% 25V RDL NP ELCTLT	1013-0042	Callins Inc	CSRNP15251
C5	CAP-100PF 5% 100V NPD MINTR CER	1005-0082	Tusonix	8121100L1G0 101J
C6	CAP-22UF 10% 15V AXL TANT	1011-0003	Sprague	150D226X901 15B2
C7	CAP-0.47UF 10% 50V MLD CER	1005-0092	Aerovox	CK0GBX474K
C8	CAP-0.022UF 1% 100V RDL POLYCARB	1008-0111	Elpac Compon	CIR223F
C9	CAP-0.022UF 1% 100V RDL POLYCARB	1008-0111	Elpac Compon	CIR223F
C10	CAP-0.022UF 1% 100V RDL POLYCARB	1008-0111	Elpac Compon	CIR223F
C11	CAP-0.022UF 1% 100V RDL POLYCARB	1008-0111	Elpac Compon	CIR223F
C12	CAP-0.022UF 1% 100V RDL POLYCARB	1008-0111	Elpac Compon	CIR223F
C13	CAP-0.022UF 1% 100V RDL POLYCARB	1008-0111	Elpac Compon	CIR223F
C14	CAP-0.022UF 1% 100V RDL POLYCARB	1008-0111	Elpac Compon	CIR223F
C15	CAP-0.022UF 1% 100V RDL POLYCARB	1008-0111	Elpac Compon	CIR223F
C16	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C17	CAP-1UF -10+50% 50V RDL ELCTLT	1013-0047	Callins Ind	CSR1501
C18	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C19	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M
C20	CAP-1UF 10% 100V RDL MET-POLYST	1008-0113	Sprague	451P105X9100J

Table 6-20. PCB Assembly SINAD (4800), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C21	CAP-0.22UF 10% 100V RDL MET-MYLAR	1008-0091	Electrocube	232A1B224K
C22	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C23	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C24	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Ind	CSR100161
C25	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C26	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C27	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Ind	CSR100161
C28	CAP-300PF 5% 500V DIP MICA	1002-0059	Elmenco	DM15F301J
C29	CAP-100PF 5% 100V NPD MINTR RED	1005-0082	Tusonix	8121100C0G0 101J
C30	CAP-470UF +100-10% 6.3V MIN RDL ELCTLT	1013-0043	Panasonic	ECEADJY471S
	DIODE			
CR1	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR2	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR3	DIO-1N3064 SI SW DO35 75PRV 0.25W	1281-0105	Fairchild	1N3064(DO35)
CR4	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR5	DIO-1N3064 SI SW DO35 75PRV 0.25W	1281-0105	Fairchild	1N3064(DO35)
	INDUCTOR			
L1	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B
L2	CH-2 1/2 TURN WIDEBAND 4B	1586-0003	Ferroxcube	VK20020/4B

Table 6-20. PCB Assembly SINAD (4800), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	TRANSISTOR			
Q1	XSTR-2N3906 PNP SI to 92 LOW PWR/SW	1272-0037	Motorola	2N390Z
Q2	XSTR-2N3906 PNP SI to 92 LOW PWR/SW	1272-0037	Motorola	2N390Z
Q3	XSTR-2N3906 PNP SI to 92 LOW PWR/SW	1272-0037	Motorola	2N390Z
	RESISTOR			
R1	RES-4.99K 1% 100PPM FILM	1075-0095	CAT.LIST	55-100
R2	RES-3.4K 1% 100PPM FILM	1075-0020	CAT.LIST	55-100
R3	RES-180K 5% 1/4W CC	1066-1845	A. Bradley	CB1845
R4	RES-330 OHM 5% 1/4W CC	1066-3315	A. Bradley	CB3315
R5	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R6	RES-5.1K 5% 1/4W CC	1066-5125	A. Bradley	CB5125
R7	RES-13K 5% 1/4W CC	1066-1335	A. Bradley	CB1335
R8	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R9	Not used			
R10	RES-390K 5% 1/4W CC	1066-3945	A. Bradley	CB3945
R11	RES-180K 5% 1/4W CC	1066-1845	A. Bradley	CB1845
R12	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R13	RES-100K 5% 1/4W CC	1066-1045	A. Bradley	CB1045
R14	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R15	RES-62K 5% 1/4W CC	1066-6235	A. Bradley	CB6235
R16	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R17	POT-100 OHM 20% 1/2 1T CERMET TRMR	1215-0054	Beckman	91AR5K
R18	RES-654.4 OHM 25% 25PPM FILM	1074-0024	CAT.LIST	55-100
R19	RES-75K 1% 100PPM FILM	1075-0135	CAT.LIST	55-025
R20	RES-654.4 OHM 25% 25PPM FILM	1074-0024	CAT.LIST	55-100
R21	RES-654.4 OHM 25% 25PPM FILM	1074-0024	CAT.LIST	55-100
R22	RES-654.4 OHM 25% 25PPM FILM	1074-0024	CAT.LIST	55-100
R23	RES-75K 1% 100PPM FILM	1075-0135	CAT.LIST	55-100
R24	POT-500K 10% 3/4W 15T CERMET TRMR	1215-0041	Beckman	89WR500K
R25	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R26	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035

Table 6-20. PCB Assembly SINAD (4800), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R27	RES-1K 1% 0.3W@70C +350OPPM AXL1 WW	1177-0012	Jordan	J120B+550OPPM
R28	RES-1.43K 1% 25PPM FILM	1074-1024	CAT.LIST	55-100
R29	POT-100 OHMN 20% 1T CERMET TRMR	1215-0054	Beckman	91AR100
R30	RES-249 OHM 1% 100PPM FILM	1074-0098	CAT.LIST	55-100
R31	POT-5K 1/2W IT CERMET TRMR	1203-0071	Beckman	91AR5K
R32	RES-20K 1% 100PPM FILM	1075-0096	CAT.LIST	55-100
R33	RES-240K 5% 1/4W CC	1066-2445	A. Bradley	CB2445
R34	POT-100 OHM 20% 1/2W CERMET TRMR	1215-0054	Beckman	91AR100
R35	POT-100 OHM 20% 1/2W CERMET TRMR	1215-0054	Beckman	91AR100
R36	POT-100 OHM 20% 1/2W CERMET TRMR	1215-0054	Beckman	91AR100
	INTEGRATED CIRCUIT			
U1	IC-3080 8 PIN OP TRANSCONO AMPL	2025-0275	RCA	CA3080E
U2	IC-1458 DUAL OP AMP 8 PIN DIP	2025-0058	Raytheon	RC1458NB
U3	IC-3130 8 PIN DIP OP AMPL	2025-0269	RCA	CA3130E
U4	IC-TL082 8 PIN DIP BIFET OP AMPL	2025-0192	Texas Instruments	TL082CP
U5	IC-1458 DUAL OP AMP 8 PIN DIP	2025-0058	Raytheon	RC1458NB
U6	IC-636J 10 PIN CAN TRU RMS-TO-DO CONV	2025-0283	Analog Dev	AD636JH
U7	IC-CA 3046 XSTR and DIO ARRAY	2025-0171	RCA	CA3046

CE-4000

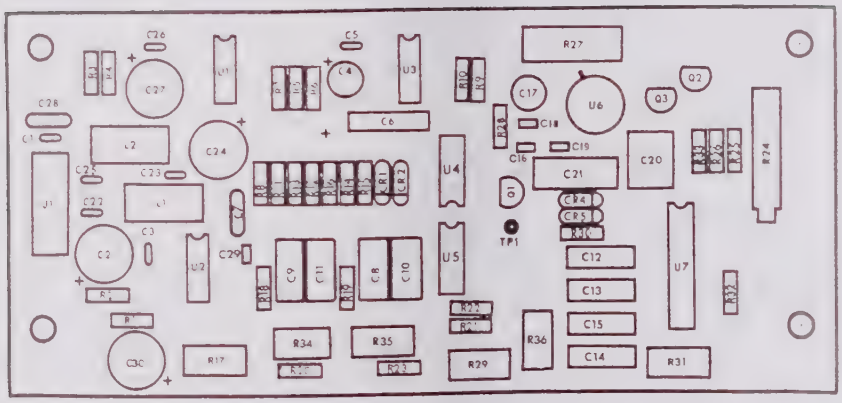


Figure 6-42. SINAD (4800) Component Location

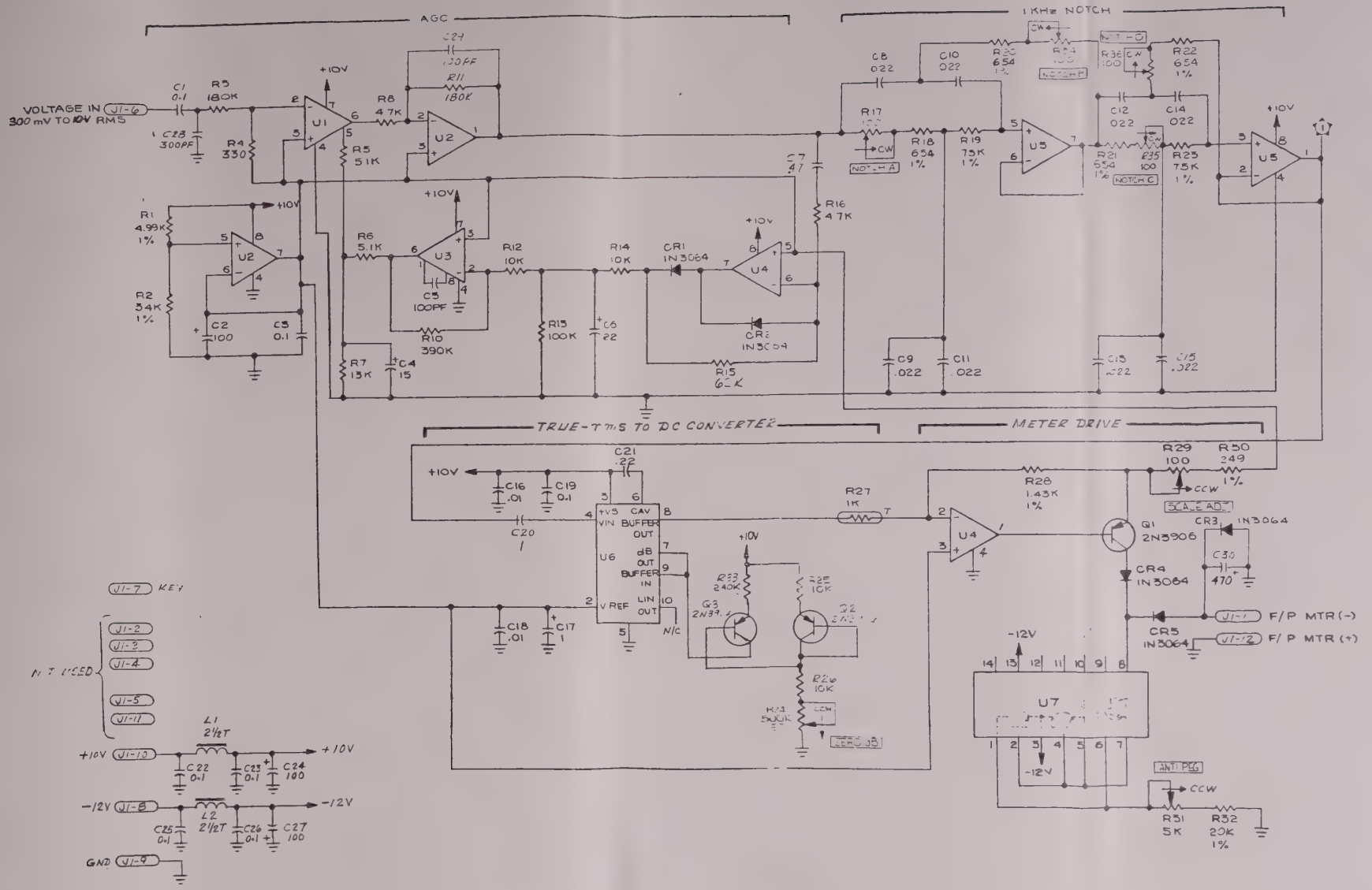


Figure 6-43. SINAD (4800) Schematic Diagram.

CE-4000

Table 6-21. Power Meter Driver (4900), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	CAPACITOR			
C1	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050561 104M
C2	CAP-15UF +75-10% 12V AXL ELCTLT	1013-0015	Sprague	30D1566012BA5
C3	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050561 104M
	DIODE			
CR1	DIO-1N3064 SI SW DO7/DO35 75 PRV 0.25W	1281-0013	Fairchild	1N3064
CR2	DIO-1N3064 SI SW DO7/DO35 75 PRV 0.25W	1281-0013	Fairchild	1N3064
	CONNECTOR			
J1	CONN-8 PIN 0.1SP RTANG LKG PCB MT JK	2535-0178		
	RESISTOR			
R1	RES-100K 5% 1/4W CC	1066-1045	A. Bradley	CB1045
R2	POT-10K 10% 3/4W 15T CERMET TRMR	1215-0014	Helitrim	89WR10K
R3	RES-51.1 OHM 1% 100PPM FILM	1075-0077	CAT.LIST	55-100
R4	RES-750 OHM 1% 100PPM FILM	1075-0043	CAT.LIST	55-100
R5	RES-5.11K 1% 150PPM FILM	1074-1018	CAT.LIST	55-100
R6	POT-20K 10% 3/4W 15T CERMET TRMR	1215-0021	Beckman	89WR
R7	POT-10K 10% 3/4W 15T CERMET TRMR	1215-0014	Helitrim	89WR10K
R8	RES-1K .5% 100PPM FILM	1075-0175	Shelly	CMF55
R9	RES-511 OHM 1% 150PPM FILM	1074-1008	CAT.LIST	55-100
R10	RES-5.11 1% 150PPM FILM	1074-1018	CAT.LIST	55-100
R11	POT-20K 10% 3/4W 15T CERMET TRMR	1215-0021	Beckman	89WR

CE-4000

Table 6-21. Power Meter Driver (4900), Parts List
(Concluded).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R12	RES-100K 5% 1/4W CC	1066-1045	A. Bradley	CB1045
R13	RES-100K 5% 1/4W CC	1066-1045	A. Bradley	CB1045
	INTEGRATED CIRCUIT			
U1	IC-UA741CP	2025-0067	Texas Inst.	UA741CP
U2	IC-4558 8PIN DIP DUAL OP AMPL	2025-2013	Texas Inst.	UA741CP

CE-4000

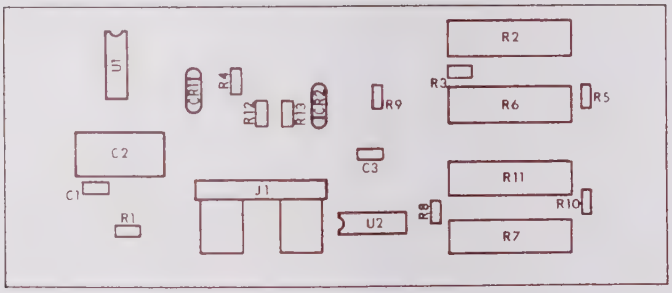


Figure 6-44. Power Meter Driver (4900) Component Location

CE-4000

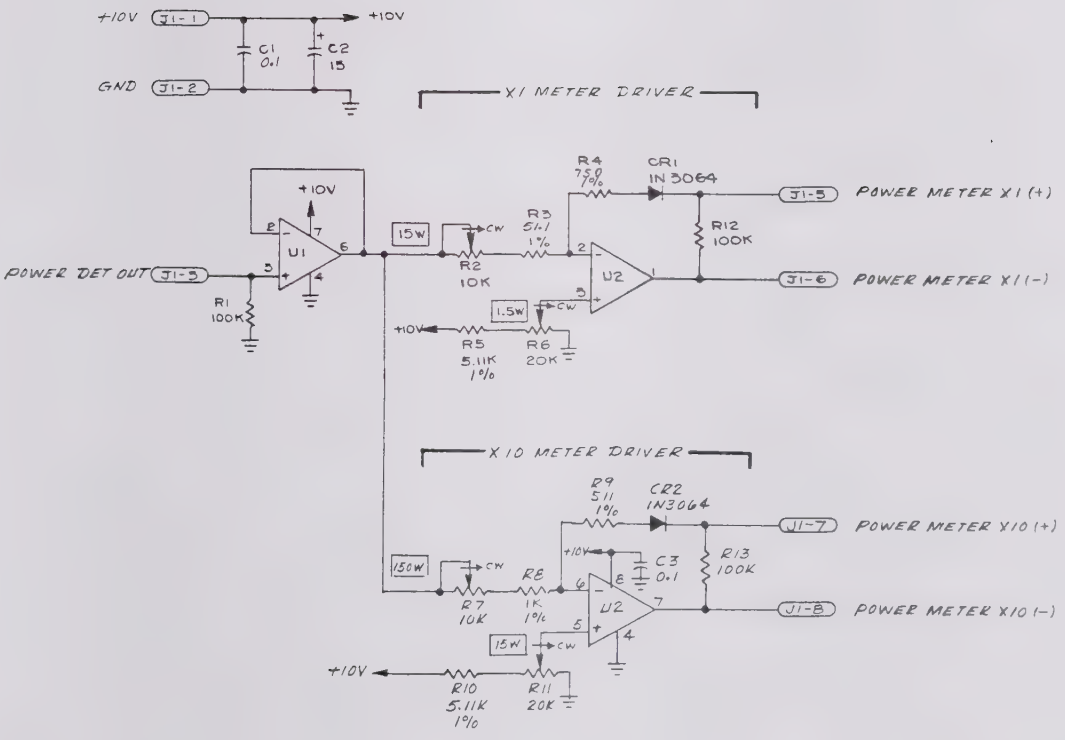


Figure 6-45. Power Meter Driver (4900) Schematic Diagram

CE-4(

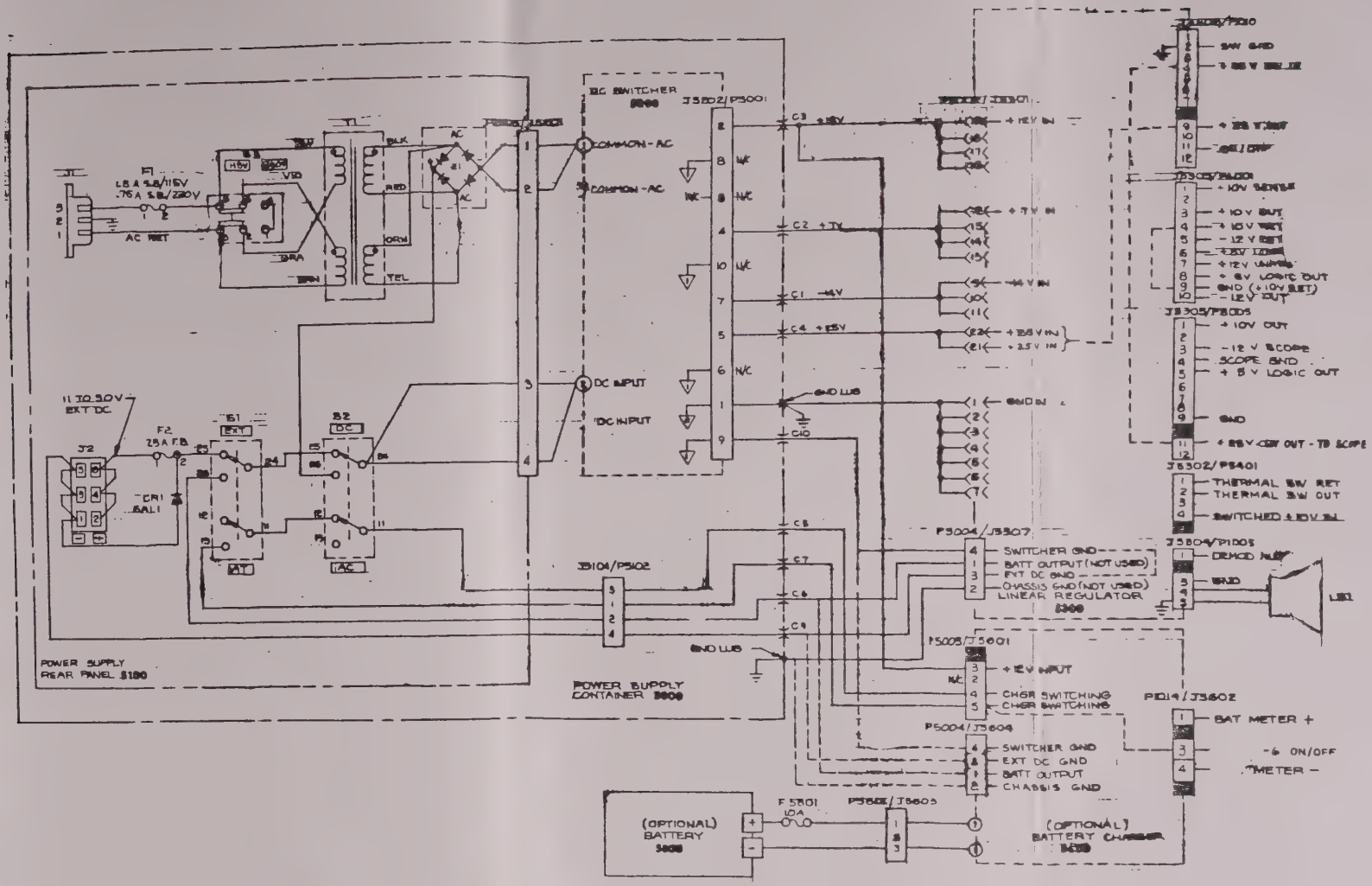


Figure 6-46. Power Supply Interconnect (5000) Schematic Diagram

CE-4000

Table 6-22. Panel Assembly - Power Supply (5100), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	DIODE			
CR1	DIO-6AL1 SI RECT 50PRV 25A	1281-0110	Sarkes Tarzian	6AL1
	CONNECTOR			
J1	CONN-3 PIN AC JK/LINE FLTR PNL MT	2535-0175		
J2	CONN-6(2x3) "JONES" PL PNL MT	2535-0177		
	SWITCH			
S1	SW-RKR 2PDT 16A 125/230VAC PNL MT	1850-0044		
S2	SW-RKR 2PDT 16A 125/230VAC PNL MT	1850-0044		
S3	SW-SLIDE 115/230V	1850-0012	Switchcraft	46256LFR
	TRANSISTOR			
T1	XFMR-PWR TORO1DAL 130VA	1575-0076	Avel Lindberg Ltd	40/3020
	RECTIFIER			
Z1	DIO-KBPC 25005 SI BRDG RECT 50PRV 24A	1281-0171		

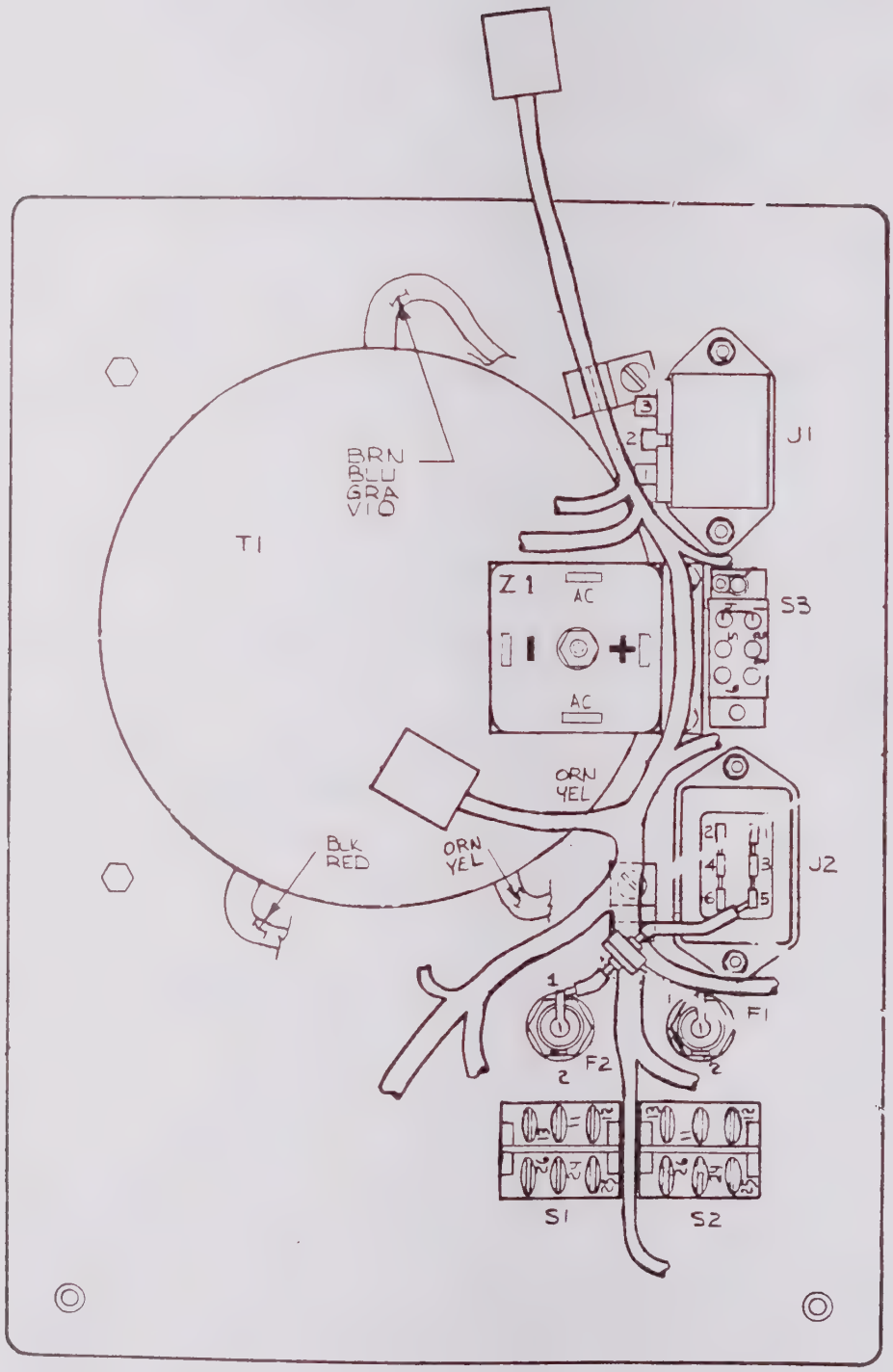


Figure 6-47. Power Supply, Rear Panel (5100) Component Location

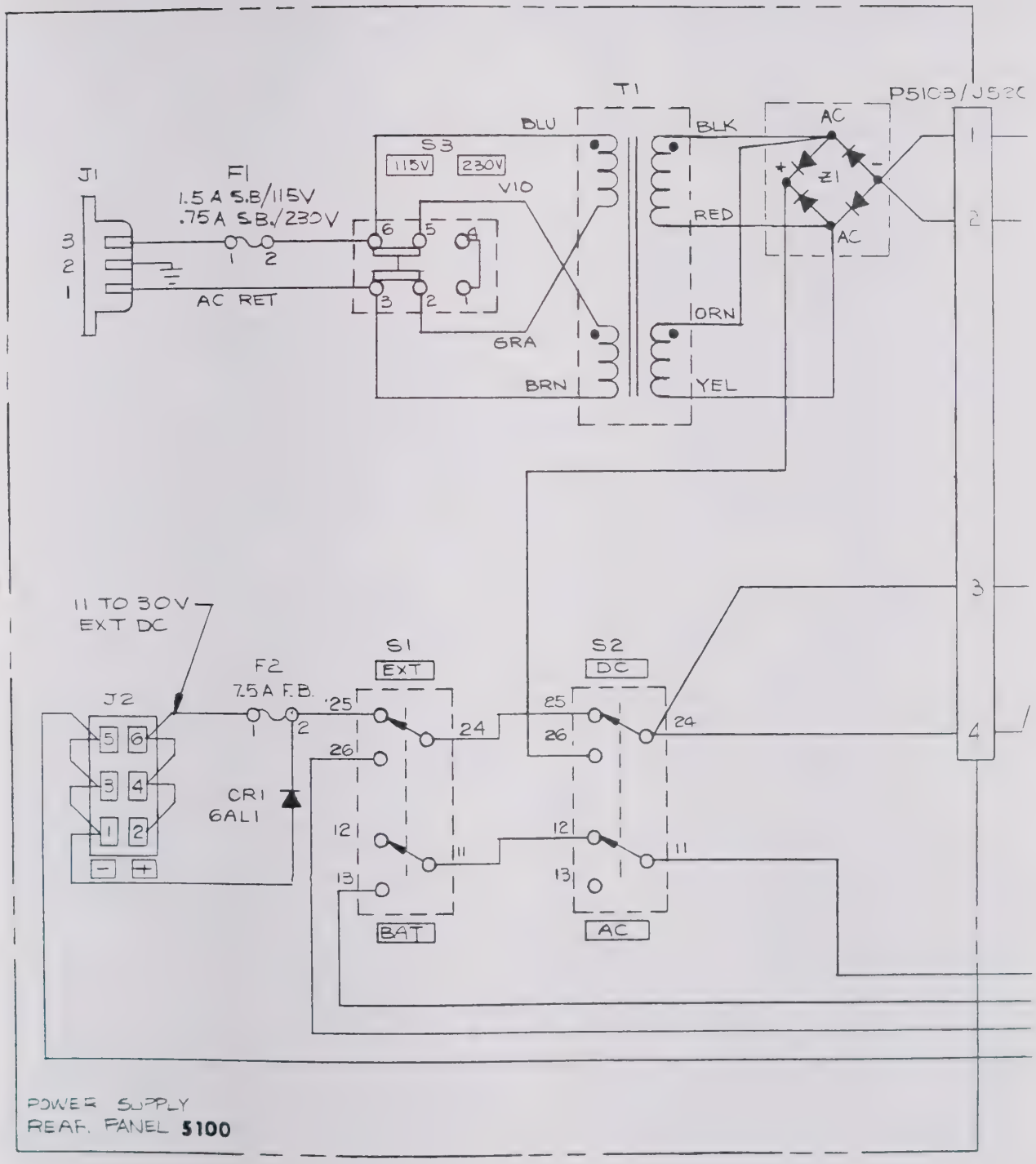


Figure 6-48. Power Supply, Rear Panel (5100) Schematic Diagram

Table 6-23. DC Switcher (5200), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	CAPACITOR			
C1	Not used.			
C2	Not used.			
C3	Not used.			
C4	Not used.			
C5	Not used.			
C6	CAP-4700UF +30-10% 35V RDL ELCTLT	1013-0056	Panasonic	ECET35R 4725W
C7	CAP-4500UF +30-10% 35V RDL ELCTLT	1013-0056	Panasonic	ECET35R 4725W
C8	CAP-4500UF +30-10% 35V RDL ELCTLT	1013-0056	Panasonic	ECET35R 4725W
C9	CAP-4500UF +30-10% 35V RDL ELCTLT	1013-0056	Panasonic	ECET35R 4725W
C10	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 104M
C11	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 104M
C12	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15E510J
C13	CAP-51PF 5% 500V DIP MICA	1002-0045	Elmenco	DM15E510J
C14	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Industries	CSR100161
C15	CAP-10UF 20% 35V RDL TANT	1011-0006	Matsuo	2Z1635021 06M3
C16	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 104M
C17	CAP-10UF 20% 35V RDL TANT	1011-0006	Matsuo	2Z1635021 06M3
C18	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C19	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 104M
C20	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 104M
C21	CAP-47UF 20% 35V RDL ELCTLT	1013-0045	Nichicon	J350KB47M
C22	CAP-0.002UF 20% 500V Z5U CER DISC	1005-0003	Tusonix	83159Z5U 202M
C23	CAP-0.002UF 20% 500V Z5U CER DISC	1005-0003	Tusonix	83159Z5U 202M

CE-4000

Table 6-23. DC Switcher (5200), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C24	Not used.			
C25	Not used.			
C26	Not used.			
C27	CAP-0.002UF 20% 500V Z5U CER DISC	1005-0003	Tusonix	83159625U 202M
C28	Not used.			
C29	Not used.			
C30	CAP-2200UF +50%-10 16V RDL ELCTLT	1013-0057	United Chemicon	SM16VB2200
C31	CAP-330UF 20% 50V RDL ELCTLT	1013-0054	Illinois Capacitor	337RLR050A
C32	CAP-330UF 20% 50V RDL ELCTLT	1013-0054	Illinois Capacitor	337RLR050A
C33	CAP-100UF 20% 50V RDL ELCTLT	1013-0053	Illinois Capacitor	107RLR050M
C34	CAP-100UF 20% 50V RDL ELCTLT	1013-0053	Illinois Capacitor	107RLR050M
C35	CAP-100UF 20% 50V RDL ELCTLT	1013-0053	Illinois Capacitor	107RLR050M
C36	CAP-100UF 20% 50V RDL ELCTLT	1013-0054	Illinois Capacitor	337RLR050A
C37	Not used.			
C38	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M
C39	CAP-0.01UF +80-20% 25V Y5U CER DISC	1005-0013	Tusonix	83159625u 202M
C40	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M
C41	CAP-10UF 20% 35V RDL TANT	1011-0006	Matsuo	2Z1635021 06M3
C42	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M
C43	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M
C44	CAP-10UF 20% 35V RDL TANT	1011-0006	Matsuo	2Z1635021 06M3
C45	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M
C46	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M
C47	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M

CE-4000

Table 6-23. DC Switcher (5200), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C48	CAP-0.01UF 20% 100V Y5P MINTR CER WHT	1005-0100	Erie	8121100651 103M
C49	Not used.			
C50	CAP-0.47UF 10% 50V MLD CER	1005-0092	Aerovox	CK06BX474K
	DIODE			
CR1	DIO-1N6286A SI SURGE LIMITER 36.8V	1281-0167	General Semi	1N6286A
CR2	DIO-1N747A SI ZENER A1 3.6V 5% 0.4W	1281-0076	Fairchild	1N747A
CR3	DIO-1N752A SI ZENER A1 5.6V 5% 0.4W	1281-0042		
CR4	DIO-1N3064-SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR5	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR6	Not used.			
CR7	DIO-G633 GE SIG DO7 1.5PF 40PRV	1282-0005	ITT	G633
CR8	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR9	DIO-1N4750 SI ZENER A98Ak 27V 10% 1W	1281-0052	Motorola	1N4750
CR10	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR11	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR12	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR13	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR14	DIO-1N4750 SI ZENER A98A 27V 10% 1W	1281-0052	Motorola	1N4750
CR15	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR16	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR17	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR18	Not used.			
CR19	Not used.			

CE-4000

Table 6-23. DC Switcher (5200), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
CR20	Not used.			
CR21	Not used.			
CR22	Not used.			
CR23	Not used.			
CR24	Not used.			
CR25	Not used.			
CR26	Not used.			
CR27	Not used.			
CR28	DIO-1305 SI F RCVY 300PRV 5A	1282-0028	Unitrode	UES1305
CR29	DIO-1404 SI F RCVY TO220 200PRV 8A	1282-0029	Motorola	MUR820
CR30	DIO-1402 SI F RCVY TO220 100PRV 8A	1282-0022	Amperex	BYW29-100
CR31	DIO-1304 SI F RCVY 200PRV 5A	1282-0027	Unitrode	UES1304
CR32	DIO-1304 SI F RCVY 200PRV 5A	1282-0027	Unitrode	UES1304
CR33	DIO-1402 SI F RCVY TO220 100PRV 8A	1282-0022	Amperex	BYW29-100
CR34	DIO-1404 SI F RCVY TO220 200PRV 8A	1282-0029	Motorola	MUR820
CR35	DIO-1305 SI F RCVY 300PRV 5A	1282-0028	Unitrode	UES1305
CR36	Not used.			
CR37	DIO-1N958B SI ZENER DO7 7.5V 5% 4W	1281-0071	Motorola	1N958B
CR38	DIO-1N747A SI ZENER A1 3.6V 5% 4W	1281-0076	Fairchild	1N3064
CR39	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR40	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR41	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR42	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
	CONNECTOR			
J1	Not used.			
J2	CONN-10 (2x5) PIN 5 0.084.DIA PCB MT	2535-0167	AMP	13809910

Table 6-23. DC Switcher (5200), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	INDUCTOR			
L1	Not used.			
L2	INDCTR-E-TYPE 42x15 50/25/42 84	1596-0322		
L3	COIL-BOB CORE 18x11/20GA/20T	1596-0321		
L4	COIL-BOB CORE 18x11/20GA/20T	1596-0321		
L5	COIL-BOB CORE 18x11/20GA/20T	1596-0321		
	TRANSISTOR			
Q1	Not used.			
Q2	XSTR-D44C8 NPN SI B22 HIGH PWR/SW	1272-0056	GE	D44C8
Q3	XSTR-D44C8 NPN SI B22 HIGH PWR/SW	1272-0056	GE	D44C8
Q4	XSTR-2N5038 NPN TO3 HIGH PWR/SW	1272-0136	RCA	2N5038
Q5	XSTR-2N5038 NPN TO3 HIGH PWR/SW	1272-0136	RCA	2N5038
Q6	Not used.			
Q7	XSTR-2N3906 PNP SI to 92 LOW PWR/SW	1272-0037	Motorola	2N3096
	RESISTOR			
R1	RES-1.2K 5% 1/4W CC	1066-1225		
R2	Not used.			
R3	RES-16.5K 1% 100PPM FILM	1075-0058	CAT.LIST	55-100
R4	RES-3.65K 1% 100PPM FILM	1075-0214	S.A.LIST	CAT55-100
R5	RES-3K 5% 1/4W CC	1066-3025		
R6	RES-75K 1% 100PPM FILM	1075-0135	CAT.LIST	55-100
R7	RES-29.4K 1% 100PPM FILM	1074-0092	CAT.LIST	55-100
R8	Not used.			
R9	RES-13.7K 1% 100PPM FILM	1075-0154	CAT.LIST	55-100

Table 6-23. DC Switcher (5200), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R10	RES-511 OHM 1% 150PPM FILM	1074-1008	CAT.LIST	55-100
R11	Not used.			
R12	RES-68.1K 1% 100PPM FILM	1075-0136	Dale	MFF 1/8TI
R13	Not used.			
R14	RES-33K 5% 1/4W CC	1066-3335	A. Bradley	CB3335
R15	RES-5.9K 1% 100PPM FILM	1075-0110	CAT.LIST	55-100
R16	POT-500 OHM 20% 1/2W 4T CERMET TRMR	1203-0063		
R17	RES-18.2K 1% 100PPM FILM	1075-0075	CAT.LIST	55-100
R18	RES-2.74K 1% 100PPM FILM	1075-0071	CAT.LIST	55-025
R19	RES-1K 1% 100PPM FILM	1075-0037	CAT.LIST	55-100
R20	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R21	RES-100K 5% 1/4W CC	1066-1045	A. Bradley	CB1045
R22	Not used.			
R23	RES-2.37K 1% 100PPM FILM	1075-0055	Dale	MFF-1/8
R24	RES-4.99K 1% 100PPM FILM	1075-0095	CAT.LIST	55-100
R25	RES-1.82K 1% 100PPM FILM	1075-0065	CAT.LIST	55-100
R26	RES-97.6 OHM 1% 100PPM FILM	1074-0101	CAT.LIST	55-100
R27	RES-2K 1% 100PPM FILM	1075-0103	CAT.LIST	55-100
R28	Not used.			
R29	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R30	RES-2.37K 1% 100PPM FILM	1075-0055	Dale	MFF-1/8
R31	RES-0.015 OHM 3% 3W AXL WW	1178-0003		
R32	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R33	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R34	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R35	RES-200 OHM 5% 1/4W CC	1066-2015	A. Bradley	CB2015
R36	RES-1 OHM 5% 2W @70C MOF	1099-0001		
R37	RES-2.2 OHM 5% 2W @70C MOF	1099-0002	RG Allen	RSU2/2.2 OHM 5%
R38	RES-1 OHM 5% 2W @70C MOF	1099-0001	RG Allen	RSU2/1 OHM 5%

Table 6-23. DC Switcher (5200), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R39	RES-2.2 OHM 5% 2W @70C MOF	1099-0002	RG Allen	RSU2/2.2 OHM 5%
R40	Not used.			
R41	Not used.			
R42	Not used.			
R43	Not used.			
R44	Not used.			
R45	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R46	Not used.			
R47	Not used.			
R48	Not used.			
R49	Not used.			
R50	RES-470 OHM 5% 1/2W CC	1067-4715	A. Bradley	CB4715
R51	RES-100 OHM 5% 1/2W CC	1067-1015	A. Bradley	CB1015
R52	RES-2.2K 5% 1/2W CC	1067-2225	A. Bradley	CB2225
R53	Not used.			
R54	Not used.			
R55	RES-887 OHM 1% 100PPM FILM	1075-0022	CAT.LIST	55-100
R56	POT-500 OHM 20% 1/2W 4T CERMET TRMR	1203-0063		
R57	RES-1.62K 1% 100PPM FILM	1075-0104	CAT.LIST	55-100
R58	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R59	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R60	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R61	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R62	RES-220 OHM 5% 1/4W CC	1066-2215	A. Bradley	CB2215
R63	RES-20K 5% 1/4W CC	1066-2035	A. Bradley	CB2035
R64	RES-20K 5% 1/4W CC	1066-2035	A. Bradley	CB2035
R65	RES-20K 5% 1/4W CC	1066-2035	A. Bradley	CB2035
	TRANSFORMER			
T1	XFMR-POT CORE 18x11 DRIVER	1575-0074		
T2	XFMR-POT CORE 18x11 DRIVER	1575-0074		
T3	XFMR-TOROIDAL BASE DRIVER	1579-0057	Mini Magnetics	C/E DWG
T4	XFMR-TOROIDAL BASE DRIVER	1579-0057	Mini Magnetics	C/E DWG
T5	XFMR-E-TYPE CORE 42x42 PWR	1575-0075	Laselco	C/E DWG & M/L

CE-4000

Table 6-23. DC Switcher (5200), Parts List (Concluded).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	INTEGRATED CIRCUIT			
U1	IC-317 TO220 3 TERM ADJ POS TGLTR	2025-0320	Motorola	LM317T
U2	IC-358 8PIN DIP AMPL/BUFFERS	2025-0311	Texas Inst	LM358P
U3	IC-339 14PIN DIP QUAD VOLTAGE COMPTR	2025-0201	Motorola	MLM339P
U4	IC-3524 16PIN DIP RGLT PLS WD MOP	2025-0179	Silicon General	SG35245
U5	IC-0026 8PIN DIP DUAL CLOCK DRVR	2025-0309	Motorola	MMH0026LP1
U6	IC-TL081 DIP J-FET-INP OP AMPL	2025-0199	Texas Inst	TI081CP
U7	IC-273 6PIN DIP OPTOISOLATOR	2025-0277	Litronix	IL-202

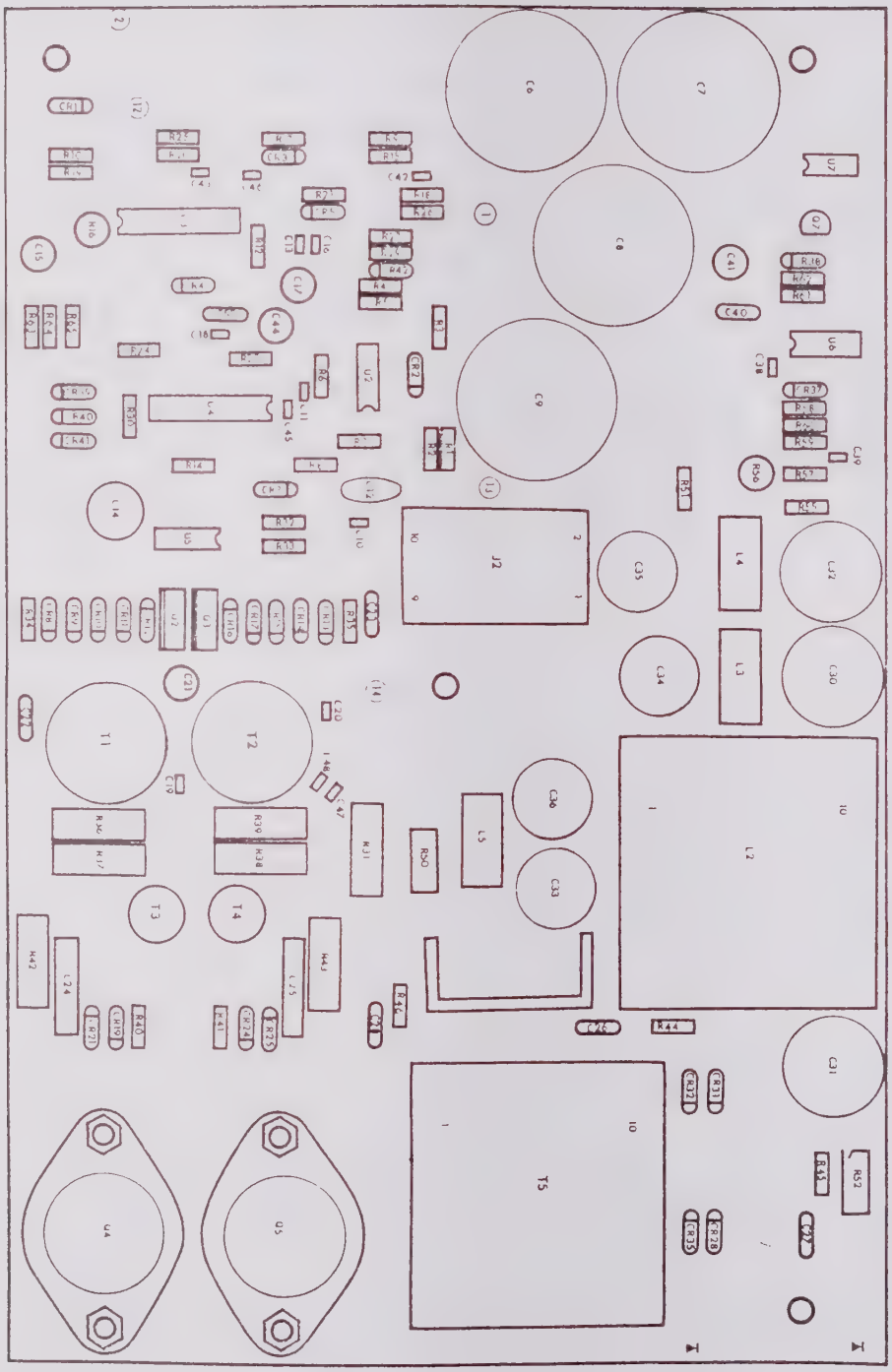


Figure 6-49. DC Switcher (5200) Component Location.

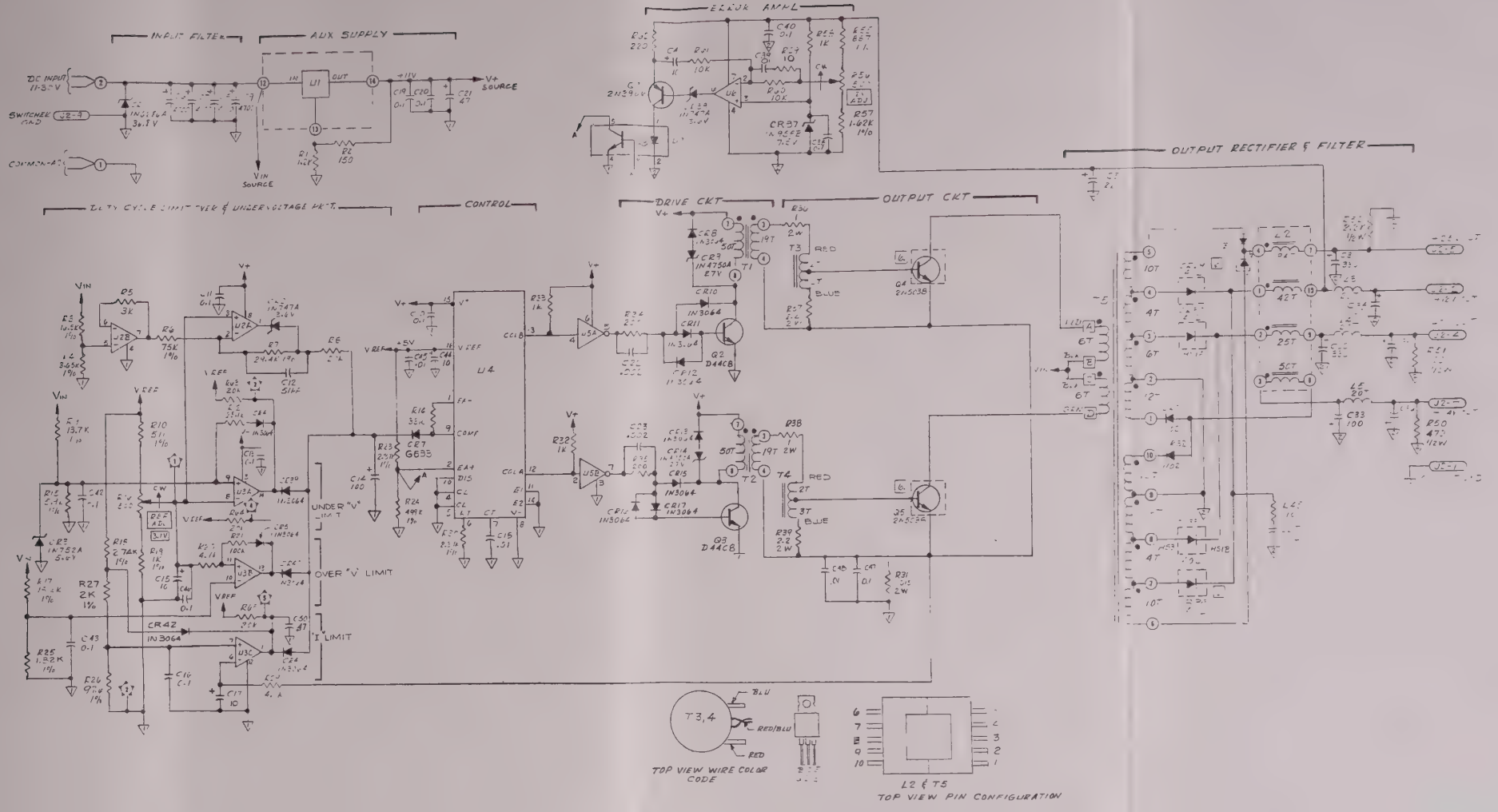


Figure 6-50. DC Switcher (5200) Schematic Diagram.

CE-4000

Table 6-24. Linear Regulator (5300), Parts List

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	CAPACITOR			
C1	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Industries	CSR100161
C2	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Capacitor	10PC25
C3	CAP-470PF 5% 500V DIP MICA	1002-0035	Sangamos Capacitor	D155F471
C4	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Capacitor	10PC25
C5	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Industries	CSR100161
C6	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Industries	CSR100161
C7	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Industries	CSR100161
C8	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 104M
C9	CAP-470PF 5% 500V DIP MICA	1002-0035	Sangamo	D155F471
C10	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121050651 104M
C11	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Capacitor	10PC25
C12	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Capacitor	10PC25
C13	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M
C14	CAP-39PF 5% 500V DIP MICA	1002-0018	Elmenco	DM15E510J
C15	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Industries	CSR100161
C16	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M
C17	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Capacitor	10PC25
C18	CAP-10UF +100-10% 25V RDL ELCTLT	1013-0035	Illinois Capacitor	10PC25
C19	CAP-1500PF 5% 500V DIP MICA	1002-0083	Elmenco	DM15E510J
C20	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Industries	CSR100161
C21	CAP-100UF -10+75% 16V RDL ELCTLT	1013-0033	Callins Industries	CSR100161

Table 6-24. Linear Regulator (5300), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
C22	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M
C23	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M
C24	CAP-0.05UF +80-20% 25V Y5U CER DISC	1005-0014	Tusonix	831596Z5u 202M
C25	CAP-0.1UF 20% 50V MINTR CER RED	1005-0097	Erie	8121100651 103M
	DIODE			
CR1	DIO-1N4741A SI ZENER A98A 11V 5% 1W	1281-0107	Motorola	1N4741A
CR2	DIO-399 ZENER TO46 MOD 6.95V 2PPM	1281-0133	National	LM399H
CR3	DIO-1N747A SI ZENER A1 3.6V 5%k 0.4W	1281-0076	Fairchild	1N747A
CR4	DIO-1N6273A SI SURGE LIMITER 10.2V	1281-0161	General Semi	1N6273A
CR5	Not used.			
CR6	DIO-1N747A SI ZENER A1 3.6V 5% 0.4W	1281-0076	Fairchild	1N747A
CR7	DIO-IN5908 SI SURGE LIMITER 5V	1281-0160	General Semi	1N5908
CR8	DIO-1N747A SI ZENER A1 3.6V 5% 0.4W	1281-0076	Fairchild	1N747A
CR9	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR10	DIO-1N4733A SI ZENER DO41 5.1V 5% 1W	1281-0031	Motorola	1N4733A
CR11	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
CR12	DIO-1N3064 SI SW DO7/DO35 75PRV 0.25W	1281-0013	Fairchild	1N3064
	CONNECTOR			
J1	Not used.			
J2	CONN-5PIN 0.025SQ 0.1SP PCB MT JK	2535-0171	Berg	65501-405
J3	CONN-10 (2x5) PIN 0.084DIA PCB MT	2535-0167	Amp	13809910
J4	CONN-5PIN 0.025SQ 0.1SP PCB MT JK	2535-0171	Berg	65501-405

Table 6-24. Linear Regulator (5300), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
J5	CONN-12 (2x6) PIN 0.1X0.1SP STR PCB MT JK	2535-0151	Berg	65610-412
J6	CONN-12 (2x6) PIN 0.1X0.1SP STR PCB MT JK	2535-0151	Berg	65610-412
	INDUSTOR			
L1	COIL-TOROIDAL 90UH/0.825DIA/20GA/39T	1595-0003	Mini Electronics	C/E DWG
L2	COIL-TOROIDAL 90UH/0.825DIA/20GA/39T	1595-0003	Mini Electronics	C/E DWG
L3	COIL-TOROIDAL 90UH/0.825DIA/20GA/39T	1595-0003	Mini Electronics	C/E DWG
L4	CH-2200UH 5% RF MLD AXL 0.22Dx0.56L	1585-0030	Delevan	2500-44
LS1	AUD IND-2850 Hz 12Y NOM	1716-0002		
	TRANSISTOR			
Q1	XSTR-MPS-U06 NPN SI B18 HIGH PWR	1272-0053	Motorola	MPS-U06
Q2	XSTR-D45H11 PNP SI B22 HIGH PWR	1272-0133	GE	D45H11
Q3	XSTR-92PU45 NPN SI DARLINGTON	1272-0113	National	2N6724
Q4	XSTR-D45H11 PNP SI B22 HIGH PWR	1272-0133	GE	D4511
Q5	XSTR-92PU45 NPN SI DARLINGTON	1272-0113	National	2N6724
Q6	XSTR-2N2905 PNP SI to 5 LOW PWR/SW	1272-0035	Motorola	2N2905
Q7	XSTR-D44C8 NPN SI B22 HIGH PWR/SW	1272-0056	GE	D44C8
Q8	XSTR-MPS-U06 NPN SI B18 HIGH PWR	1272-0053	Motorola	MPS-U06
Q9	XSTR-MPS-U55 PNP SI B18 HIGH PWR	1272-0074		
Q10	XSTR- 2N3906 PNP SI to 92 LOW PWR/SW	1272-0037	Motorola	2N3906
Q11	XSTR-2N3904 NPN SI to 92 LOW PWR/SW	1272-0032	Motorola	2N3904

Table 6-24. Linear Regulator (5300), Parts List (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
Q12	XSTR-2N3906 PNP SI to 92 LOW PWR/SW	1272-0037	Motorola	ZN3906
Q13	XSTR-2N3904 NPN SI to 92 LOW PWR/SW	1272-0032	Motorola	ZN3904
Q14	XSTR-2N3906 PNP SI to 92 LOW PWR/SW	1272-0037	Motorola	ZN3906
Q15	XSTR-2N3906 PNP SI to 92 LOW PWR/SW	1272-0037	Motorola	ZN3906
	RESISTOR			
R1	RES-47 OHM 5% 1/4W CC	1066-4705	A. Bradley	CB4705
R2	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R3	RES-47 OHM 5% 1W CC	1068-4705	A. Bradley	CB4705
R4	RES-1.5K 1% 100PPM	1075-0039	CAT.LIST	55-100
R5	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R6	RES-3.3K 5% 1/4W CC	1066-3325	A. Bradley	CB3325
R7	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R8	RES-1.62K 1% 25PPM FILM	1075-0070	CAT.LIST	55-100
R9	POT-1K 10% 3/4W 15T CERMET TRMR	1215-0013	Helitrim	89WR
R10	RES-4.5K 1% 25PPM FILM	1075-0066	CAT.LIST	55-100
R11	RES-10K 1% 100PPM FILM	1075-0009	CAT.LIST	55-100
R12	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R13	RES-8.2 OHM 5% 1/2W CC	1067-0004	A. Bradley	EB8265
R14	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R15	RES-3.3K 5% 1/4W CC	1066-3325	A. Bradley	CB3325
R16	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R17	RES-10K 1% 100PPM FILM	1075-0009	CAT.LIST	55-100
R18	RES-10K 5% 1/4W CC	1066-1035	A. Bradley	CB1035
R19	RES-20K 1% 100PPM FILM	1075-0096	CAT.LIST	55-100
R20	RES-20K 1% 100PPM FILM	1075-0096	CAT.LIST	55-100
R21	RES-62 OHM 5% 1/4W CC	1066-6205	A. Bradley	CB6205
R22	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R23	RES-10K 1% 100PPM FILM	1075-0009	CAT.LIST	55-100
R24	RES-5.62K 1% 100PPM FILM	1075-0013	CAT.LIST	55-100
R25	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R26	RES-180 OHM 5% 1W CC	1068-1815	A. Bradley	CB1815
R27	RES-12.1K 1% 100PPM FILM	1075-0011	CAT.LIST	55-100
R28	RES-750 OHM 5% 1/4W CC	1066-7515	A. Bradley	CB7515

Table 6-24. Linear Regulator (5300), Parts List (Concluded).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R29	RES-100 OHM 5% 1/4W CC	1066-1015	A. Bradley	CB1015
R30	RES-1.5K 5% 1/4W CC	1066-1525	A. Bradley	CB1525
R31	RES-8.2K 5% 1/4W CC	1066-8225	A. Bradley	CB8225
R32	RES-5.1 OHM 5% 1/4W CC	1066-0002	A. Bradley	CB5165
R33	RES-5.1 OHM 5% 1/4W CC	1066-0002	A. Bradley	CB5165
R34	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R35	RES-8.2K 5% 1/4W CC	1066-8225	A. Bradley	CB8225
R36	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R37	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R38	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R39	RES-0.25 OHM 3% 3W 90PPM AXL WW	1159-0003	Dale	RS-ZB
R40	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R41	RES-0.25 OHM 3% 3W	1159-0003	Dale	RS-ZB
R42	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R43	RES-4.7K 5% 1/4W CC	1066-4725	A. Bradley	CB4725
R44	RES-51K 5% 1/4W CC	1066-5135	A. Bradley	CB5135
R45	RES-0.5 OHM 3% 3W 90PPM AXL WW	1159-0002	Dale	RS-ZB
R46	RES-1K 5% 1/4W CC	1066-1025	A. Bradley	CB1025
R47	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R48	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R49	RES-510 OHM 5% 1/4W CC	1066-5115	A. Bradley	CB5115
R50	RES-10 OHM 5% 1/4W CC	1066-1005	A. Bradley	CB1005
R51	RES-22 OHM 5% 1/4W CC	1066-2205	A. Bradley	CB2205
R52	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
R53	RES-47K 5% 1/4W CC	1066-4735	A. Bradley	CB4735
	INTEGRATED CIRCUIT			
U1	IC-358 8PIN DIP OP AMPL/BUFFERS	2025-0311	Texas Instruments	LM358P
U2	IC-358 8PIN DIP OP AMPL/BUFFERS	2025-0311	Texas Instruments	LM358P
U3	IC-UA741CP	2025-0067	Texas Instruments	UA741CP

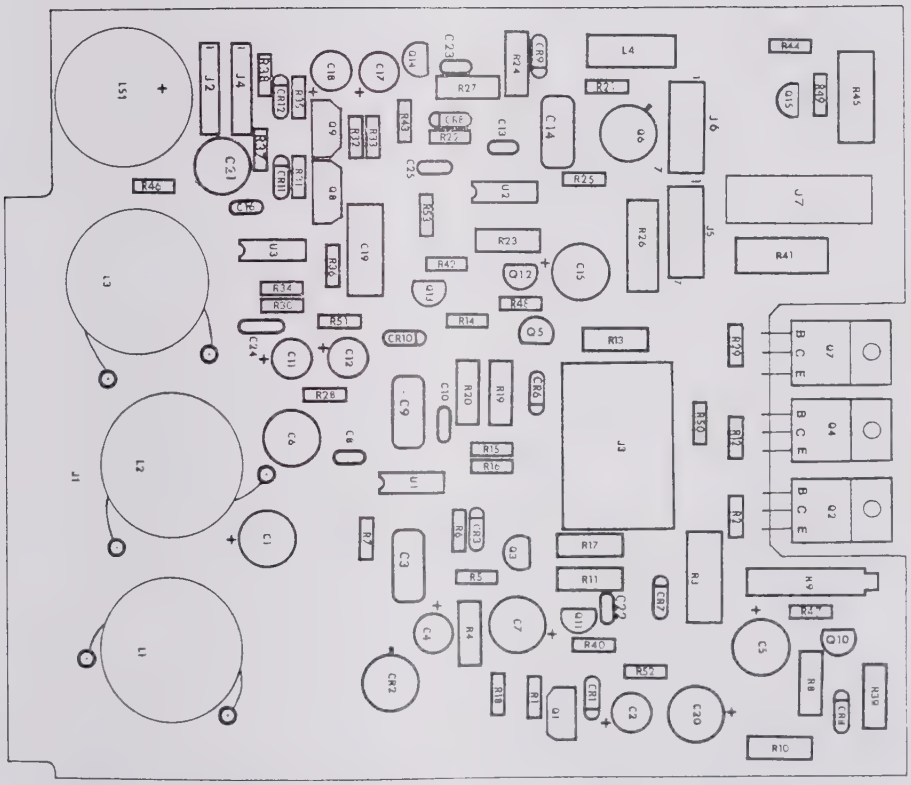


Figure 6-51. Linear Regulator (5300) Component Location.

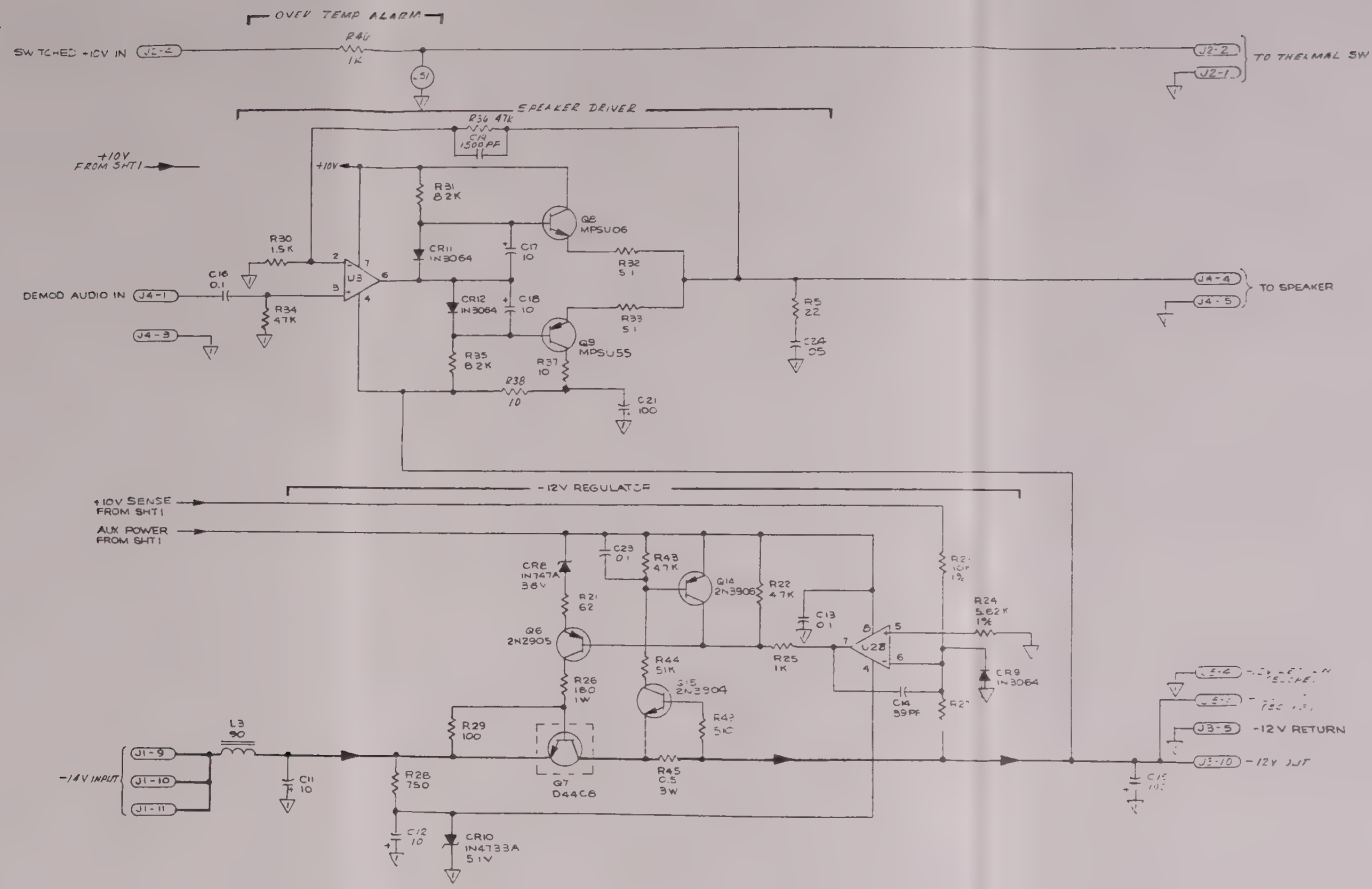


Figure 6-52. Linear Regulator (5300) Schematic Diagram.

Table 6-25. High Level Amplifier (7100) Parts List.

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	CAPACITOR			
C1	CAP-0.1UF 20% 50V BX CER CHIP	1012-0038	Viclan	129B104MZP
C2	CAP-0.1UF 20% 50V BX CER CHIP	1012-0038	Viclan	129B104MZP
C3	CAP-0.1UF 20% 50V BX CER CHIP	1012-0038	Viclan	129B104MZP
C4	CAP-0.1UF 20% 50V BX CER CHIP	1012-0038	Viclan	129B104MZP
C5	CAP-0.1UF 20% 50V BX CER CHIP	1012-0038	Viclan	129B104MZP
C6	CAP-0.1UF 20% 50V BX CER CHIP	1012-0038	Viclan	129B104MZP
C7	CAP-0.1UF 20% 50V BX CER CHIP	1012-0038	Viclan	129B104MZP
	INTEGRATED CIRCUIT			
U1	IC-1061 TO12 CASCADABLE AMPL	2025-0282	Avantek	GPD-1061
U2	IC-1062 TO12 CASCADABLE AMPL	2025-0279	Avantek	GPD-1062
U3	IC-1063 TO12 CASCADABLE AMPL	2025-0280	Avantek	GPD-1063

CE-4000

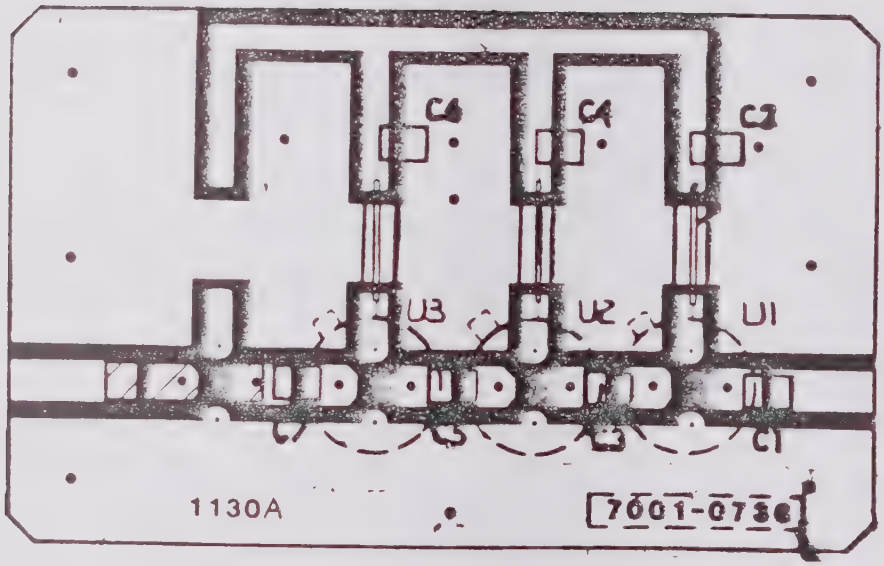


Figure 6-53. High Level Amplifier (7100) Component Location

CE-4000

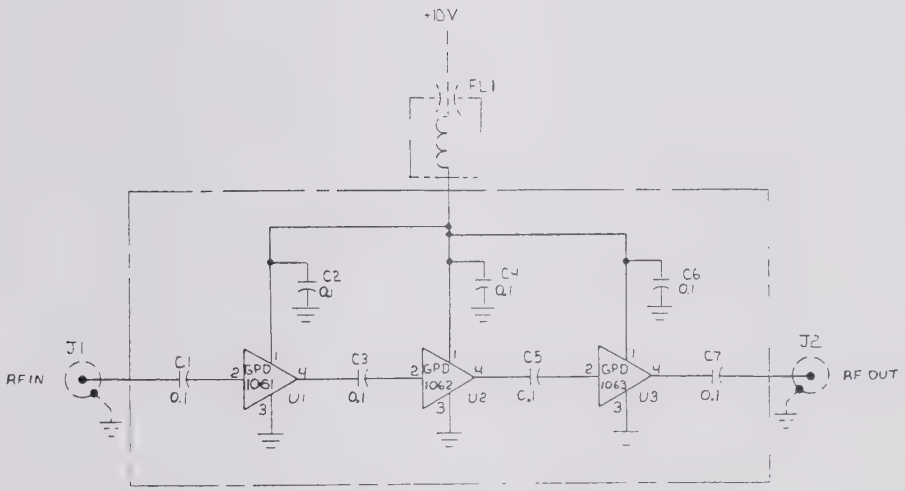


Figure 6-54. High Level Amplifier (7100) Schematic Diagram.

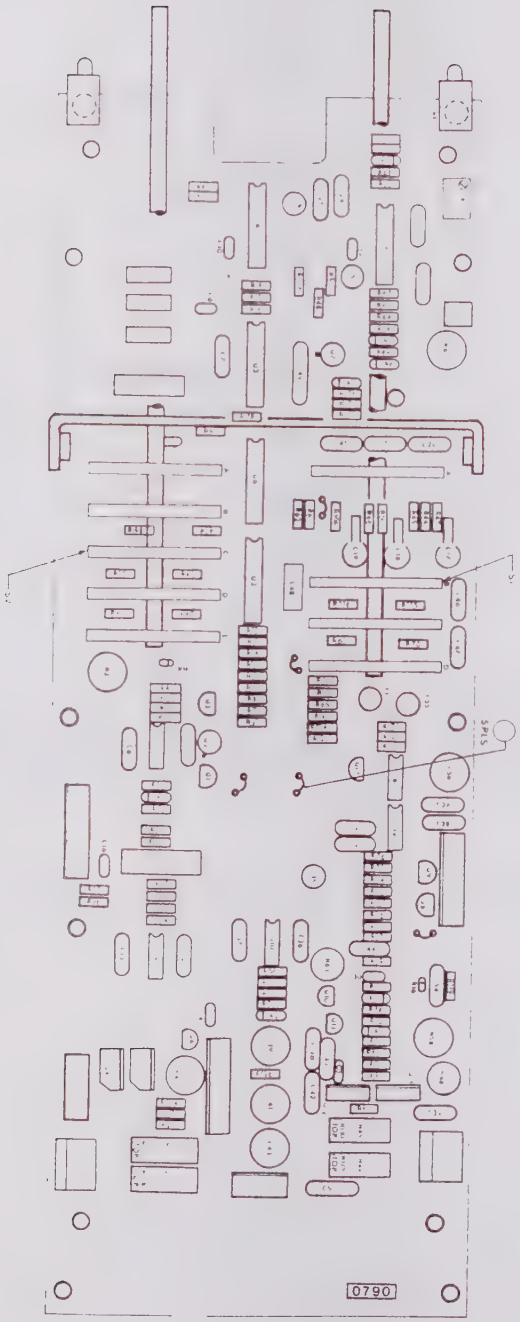


Figure 6-55. Oscilloscope (8200) Component Location.

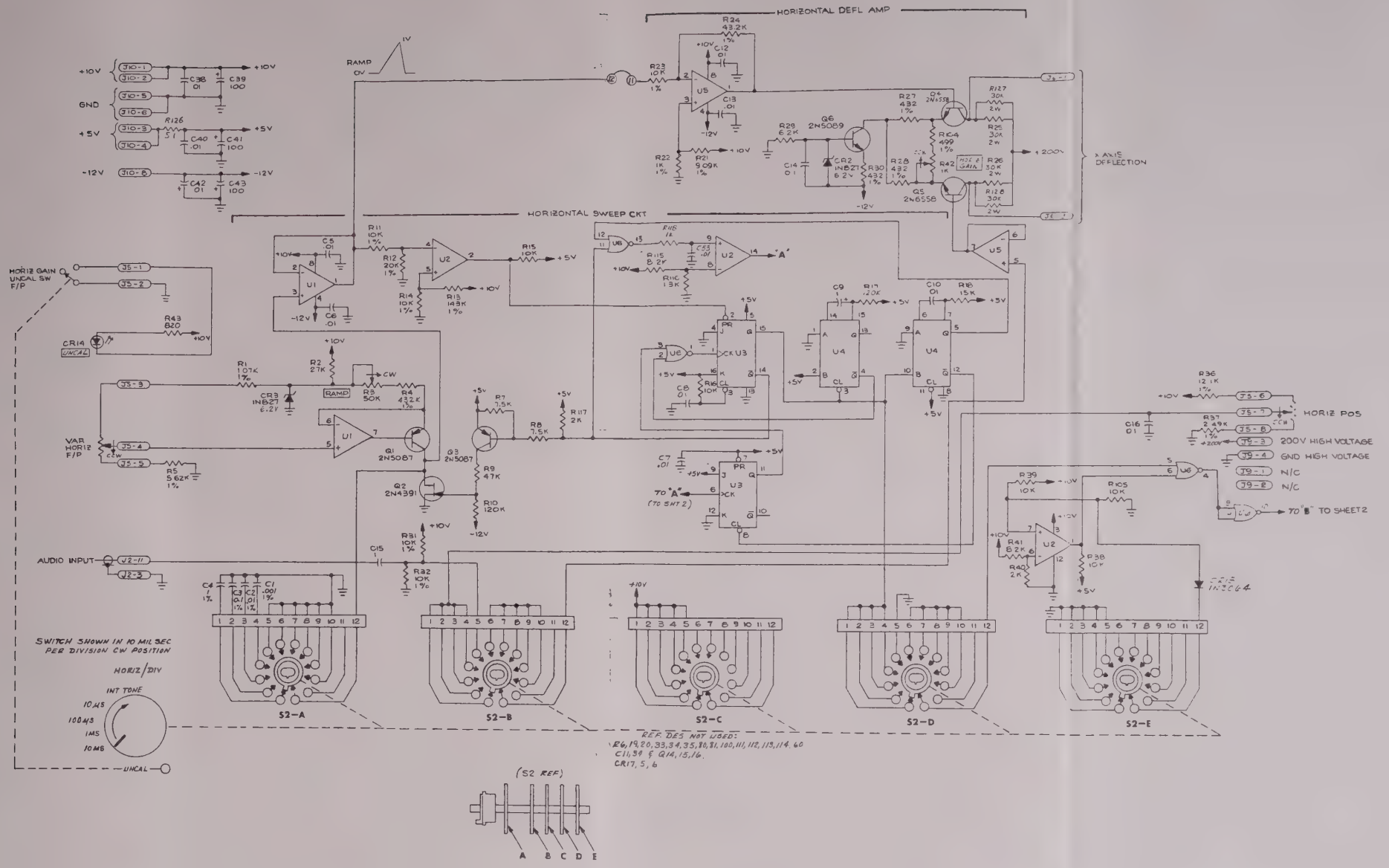


Figure 6-56. Oscilloscope (8200) Schmatic Diagram

Table 6-26. H.V. Power Supply (8300) Parts List.

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	CAPACITOR			
C1	CAP-0.068UF 10% 100V RDL POLYESTER	1008-0036	Sprague	225P68391WA3
C2	CAP-0.068UF 10% 100V RDL POLYESTER	1008-0036	Sprague	225P68391WA3
C3	CAP-100UF +100-10% 50V RDL ELCTLT	1013-0036	Illinois Capacitor	100R50
C4	CAP-0.01UF 20% 1.4V 1.4KV CER DISC	1005-0051	Sprague	125LS10
C5	CAP-0.01UF 20% 1.4V 1.4KV CER DISC	1005-0051	Sprague	125LS10
C6	CAP-10UF+50-10% 250V RDL ELCTLT	1013-0051	Illionis Capacitor	106RAR250A
C7	CAP-0.01UF 20% 1.4V 1.4KV CER DISC	1005-0051	Sprague	125LS10
C8	CAP-0.01UF 20% 1.4V 1.4KV CER DISC	1005-0051	Sprague	125LS10
C9	CAP-0.047UF 10% 4KV AXL MET-MYLAR	1008-0083		
C10	CAP-0.01UF 20% 1.4V 1.4KV CER DISC	1005-0051	Sprague	125LS10
C11	CAP-0.05UF +80-10% 500V Z5U CER DISC	1005-0052	Sprague	5HK-S50
C12	CAP-0.01UF 20% 3KV Z5U CER DISC	1005-0069	Sprague	30GA-2/10
C13	CAP-100UF +100-10% 50V RDL ELCTLT	1013-0036	Illinois Capacitor	100R50
	DIODES			
CR1	DIO-1N4747A SI ZENER A98A 20V 5% 1W	1281-0119	TRW	V947B
CR2	DIO-1N747A SI ZENER A1 3.6V 5% 4W	1281-0076	Fairchild	1N3064
CR3	DIO-1N494B SI F RCVY AITC 1000PRV 1A	1282-0019	Semi Conductor	MRF1000
CR4	DIO-1N494B SI F RCVY AITC 1000PRV 1A	1282-0019	Semi Conductor	MRF1000
CR5	DIO-1N494B SI F RCVY AITC 1000PRV 1A	1282-0019	Semi Conductor	MRF1000
CR6	DIO-1N494B SI F RCVY AITC 1000PRV 1A	1282-0019	Semi Conductor	MRF1000

Table 6-26. H.V. Power Supply (8300) Parts List. (Continued).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
	CONNECTOR			
J1	CONN-5PIN 0.25SQ 0.1SP PCB MT JK	2535-0171	Berg	65501-405
J2	CONN-5PIN 0.24SQ 0.1SP PCB MT JK	2535-0171	Berg	65501-405
	INDUCTOR			
L1	COIL-TOROIDAL 1MH/1.2DIA/24GA/140T	1595-0004	Mini Magnetics	C/E DWG&M/L
L2	Not used.			
L3	INDCTR-POT CORE 18x11/240T/38GA	1596-0323	Texas Instruments	TIP33A
	TRANSISTOR			
Q1	XSTR-MJE 13007 NPN SI TO220AB HIGH PWR	1272-0115	Motorola	MJE13007
Q2	XSTR-MJE 13007 NPN SI TO220AB HIGH PWR	1272-0115	Motorola	MJE13007
Q3	XSTR-TIP33A NPN SI X86 HIGH PWR/SW	1272-0084		
Q4	XSTR-MPS-U06 NPN SI B18 HIGH PWR	1272-0053	Motorola	MPS-U06
	RESISTOR			
R1	RES-330 OHM 5% 3W 20PPM AXL WW	1159-0011	Dale	RS-2B
R2	RES-68 OHM 5% 1/2W CC	1067-6805		
R3	RES-0.5 OHM 3% 3W 90PPM AXL WW	1159-0002	Dale	RS-2B
R4	POT-1MEG 10% 1/2W LIN 1/8 SFT CC	1203-0122	A. Bradley	WA2G056S105UA
R5	POT-500K 20% 1/2W 1T CERMET TRMR	1215-0062	Beckman	91AR500K
R6	RES-470K 5% 1/2W CC	1067-4745	A. Bradley	CB4745
R7	RES-22K 5% 1/2W CC	1067-2235	A. Bradley	CB2235
R8	RES-22K 5% 1/2W CC	1067-2235	A. Bradley	CB2235
R9	RES-22K 5% 1/2S CC	1067-2235	A. Bradley	CB2235
R10	RES-390K 5% 1/2W CC	1067-3945	A. Bradley	CB3945
R11	POT-500K 10% 1/2W LIN	1203-0121	A. Bradley	QA2G0563405UA

CE-4000

Table 6-26. H.V. Power Supply (8300) Parts List. (Concluded).

REF. NO.	DESCRIPTION	CE STOCK NO.	MANUFACTURER	MFR. NO.
R11	POT-500K 10% 1/2W LIN	1203-0121	A. Bradley	WA2G056S504UA
R12	RES-620K 5% 1/2W CC	1067-6245	Ohmite	OE6245
R13	RES-510K 5% 1/2W CC	1067-5145	Ohmite	OE5145
R14	RES-510K 5% 1/2W CC	1067-5145	Ohmite	OE5145
R15	RES-51K 5% 1/4W CC	1066-5135	Ohmite	OE5135
R16	RES-51K 5% 1/4W CC	1066-5135	Ohmite	OE5135
R17	POT-100K 20% 1/2 1T CERMET TRMR	1215-0046	Beckman	91AR 100K
R18	RES-51K 5% 1/4W CC	1066-5135	A. Bradley	OE51354
R19	Not used.			
R20	Not used.			
R21	Not used.			
R22	Not used.			
R23	Not used.			
R24	Not used.			
R25	RES-4.3 OHMk 5% 1W CC	1068-0001	A. Bradley	GB5135
	TRANSFORMER			
T1	XFMR-POT CORE 30x19	1575-0071		
	RECTIFIER			
Z1	DIO-1DB400R SI BRDG RECT 400PRV 1A	1281-0164	Codi	1DB400R

CE-4000

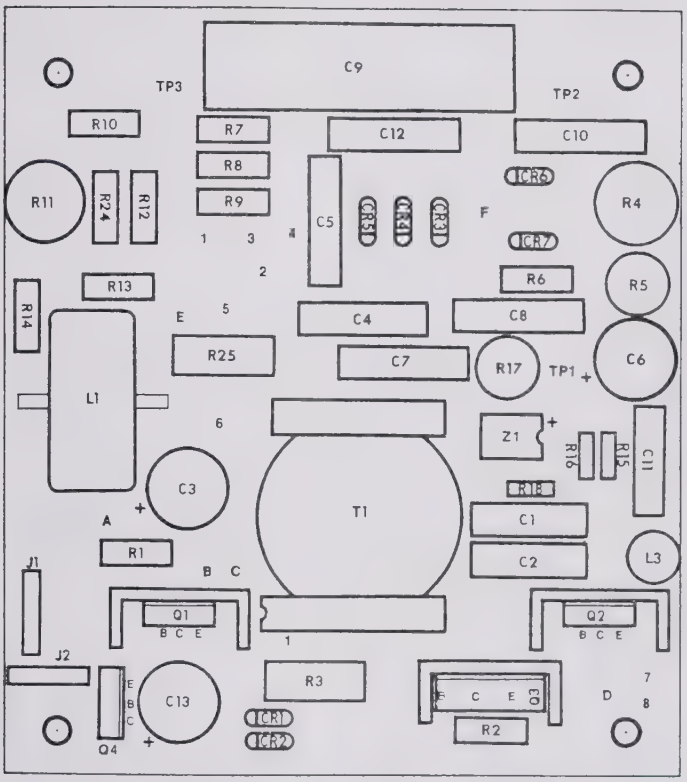


Figure 6-57. H.V. Power Supply (8300) Component Location

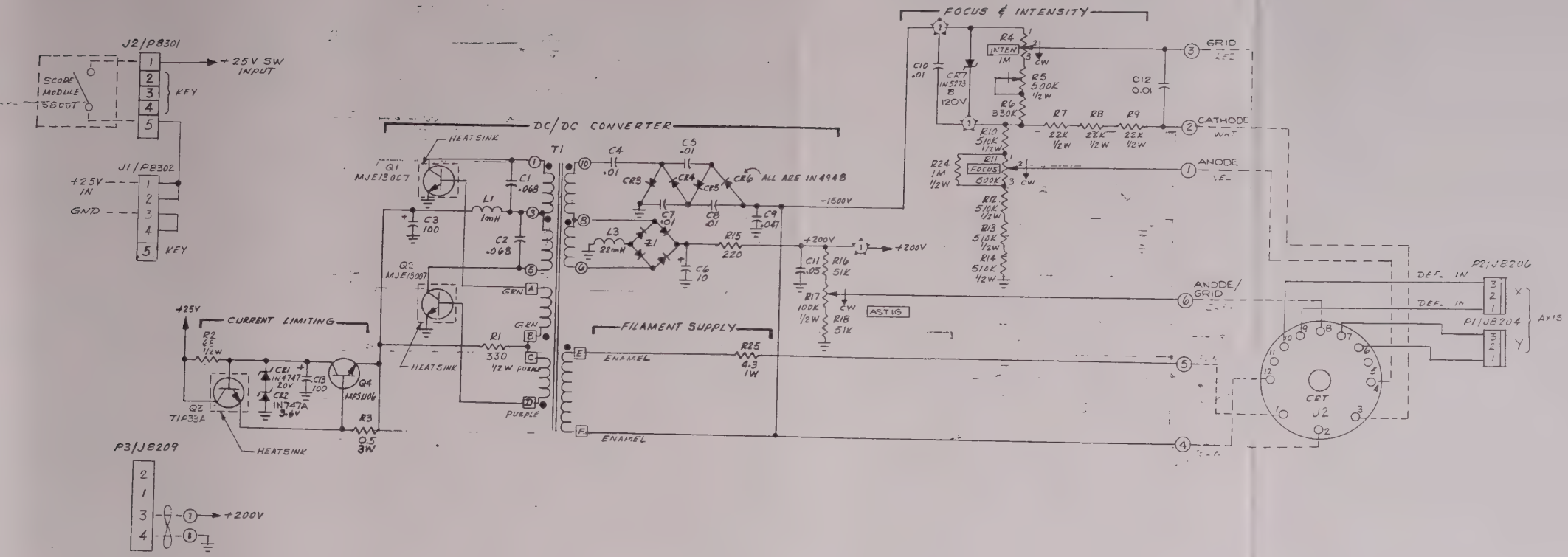


Figure 6-58. H.V. Power Supply (8300) Schematic Diagram.

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